amateur radio

Vol. 39, No. 3
MARCH, 1971
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amateur radio

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Reg. Office: 478 Victoria Parade, East Melbourne, Vic., 3002.

Editor:
K. E. PINCOTT VK3AFJ

Publications Committee:
R. Dorin VK3AIY
Ken Gillespie VK3GK
Harold Hepburn (Secretary) VK3AFQ
Peter Ramsay VK3ZWN
W. E. J. Roper VK3ARZ

Circulation—
Jack Kelly VK3AFD

Draughtsmen:—
Clem Allan VK3ZIV
John Blanch VK3ZOL
John Whitehead VK3YAC

Enquiries:
Mrs. BELLAIRS, Phone 41-3535, 478 Victoria Parade, East Melbourne, Vic., 3002. Hours: 10 a.m. to 3 p.m. only.

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CONTENTS

COVER STORY

Pictured on our front cover this month is a 'Rapar' V.T.V.M., one of many pieces of test equipment designed for amateur and commercial use, that is available from Radio Parts, Melbourne.

FEDERAL COMMENT—MEMBERS

In recent months I have attended a number of meetings of Amateurs in various parts of Australia. I have usually been asked to speak on the present activities of our Federal body and in doing this I have referred to many of the difficulties that presently face us. One topic that has very often given rise to quite spirited discussion is whether or not we should be able to look to a significant increase in our membership and, if so, how this can be achieved.

You may recall that in the Federal Executive's report submitted to the last Federal Convention, a table was published showing the number of members as against the number of licensees in each State. As we have not yet received the membership figures from all of the Divisions as at 30th December, 1970, we as yet have been unable to up-date that table. However, this will be included in the Federal Executive report to be submitted to the next Federal Convention which will be held in Brisbane at Easter this year.

Australia-wide, as at 30th December, 1969, 54% of all licensees were members of the Institute. It is this figure that generally gives rise to extensive discussion. Of course, this figure must be treated with some caution. There are a certain number of people who retain their licence for many years but are in no way active. These people may have developed other interests or may retain the call sign allocated to them for only sentimental reasons. It is, I think, probably unreal to expect a 100% membership; the really difficult question is to determine what is a realistic percentage of licensees that the Institute can expect to be members. We know, for example, that the Radio Society of Great Britain has a membership of approximately 65%.

I would suggest that a 75% membership or even an 80% membership should be attainable. This figure would take into account all of those licensees who are really no longer interested, in a long term sense, in the hobby.

I do not think that we should disregard those who have temporarily other interests. If someone is contemplating coming back to the hobby, then he probably will have sufficient interest to remain or become a member.

The discussions I have heard on this topic have produced a number of suggested reasons as to why people are not members. It is worthwhile considering some of these suggestions as the reasons, if valid, may provide solutions.

There are, of course, some people who are "anti-Institute", either because of some incident in the past or because they do not know enough about the Institute and are proceeding on the basis of their own assumptions as to what the Institute is all about. There are, it is suggested, many people who are not members because, whilst not being "anti-Institute", they just did not know enough about what it is doing. Then, there are those people who are not members simply because they feel that the Institute cannot offer them anything worthwhile to justify their being members.

In a way, people falling into these various categories have something in common—a lack of knowledge of the fundamental role of the Institute to represent the Amateur Service. Perhaps even if the Institute offered nothing more than an effective medium to defend Amateur frequencies, many of these people would be prepared to become members.

But is it important that we seek more members? More and more of the Institute's resources and, therefore, its funds, are being directed to the representation and the defence of the position of Radio Amateurs. Our involvement in the I.A.R.U. Region 3 Association—which takes 20c per annum from each member's subscription—is because the Federal Council sees the importance of the attitudes of other administrations to the Amateur Service when questions of frequency allocation and regulation arise at an International level.

More and more, the Federal Executive is called upon to prepare detailed submissions in support of its position in its discussions with the Central Administration of the Postmaster-General's Department.

What results can the Institute show for which it is doing? I can now state that the proposals of the Australian Administration to the World Administrative Radio Conference Relating to Space Communications, which will commence in Geneva in June this year, contain no proposal that affects either directly or consequently any Amateur frequency below 20 GHz.

In addition, the Australian Administration has adopted almost in toto the Wireless Institute's submissions in relation to the use of space by the Amateur Service and these proposals now form part of the Australian proposal.

If the Wireless Institute of Australia is successful in retaining, against pressure, any new privilege, this is to the benefit of not only our members but for the benefit of all Amateurs. To put it even more succinctly, Amateurs who take the benefit of what the Institute does, but do not, by being non-members, share the cost, make the cost greater for those who are members.

These facts have been highlighted by many of the discussions I have heard on this topic.

Usually the discussion has then turned to membership drives and other means of attracting new members. There are various things that can be done at a Divisional level though I believe that the best salesmen for membership are, in fact, the existing members. If each member made it his business to seek one new member in the forthcoming year, I am sure that we could see a significant change in our membership pattern, particularly in the three larger States of Queensland (in terms of size), New South Wales and Victoria, where the percentage of licensees as members is smallest.

There are, of course, other areas of the Institute's activities that can be improved and which will, if they are improved, make membership more attractive. For example, any improvement in this magazine should make the direct tangible benefits of membership more attractive. Have you any ideas? Let's hear them—perhaps write a letter to the Editor.

In the last resort though, it is our own enthusiasm as members that will attract more members. This magazine only goes to members, therefore it is going only to those people who already support the organisation. Can you support it now by finding another member?

MICHAEL J. OWEN, VK3KI,
Federal President, W.I.A.

A Transistorised Carphone

PART ONE—THE RECEIVER

By L. B. JENKINS,† VK3ZBJ, and H. L. HEPBURN,‡ VK3AFQ

To a greater or less extent most readers will be aware that the engineering team working on the Australis Oscar project must, of necessity, be examining, selecting and using fairly advanced techniques. This and subsequent articles will attempt to show how some of the Australis work has been utilised to produce a fully transistorised f.m. carphone for the two metre nets.

INTRODUCTION

This article will describe the receiver portion of the complete transceiver and will be followed by a second article on the transmitter.

Fig. 1 gives the block schematic of the unit, whilst Figs. 2 and 3 give the appropriate circuit diagrams.

In the electrical design two i.f's were used. The first i.f. is on 10.7 MHz. to allow use of freely available filters on this frequency and to be high enough to minimise image problems. The second i.f. is on 455 MHz., again to make use of freely available components.

Since the most likely end use for a transistorised f.m. receiver is in mobile systems, the h.t. supply was set at 12.5 volts and all design centred round this voltage. The unit will operate satisfactorily between 11.5 and 13.6 volts although, naturally, the transmitter output falls off at the lower figure.

Considerable attention has been paid to physical layout both from the constructional point of view and also with respect to ease of adjustment. Although the finished transceiver is small (the prototype is housed in a cabinet 4½" high x 10" wide x 10" deep) no attempt has been made to fully miniaturise it.

The complete receiver has been made on one p.c.b. 7½" x 4¼", while the transmitter is made in three parts. The exciter/audio modulator is on a p.c.b. 1½" x 7½" and provides a 100 mW. f.m. modulated signal to the second p.c.b. which uses a Motorola 2N5589 to raise the power to some 1-2 watts. This stage in turn feeds a 2N5590 p.a. stage on a third p.c.b. to give a conservative 10 watts of output.

All p.c.b's are mounted on a shallow "U" shaped aluminium sub-chassis with the receiver board in the bottom of the "U", the exciter board on one vertical side of it and the two power stages on the other vertical side. The front panel contains the speaker and the various operating controls. Fig. 4 gives the general layout of the boards and control components.

THE RECEIVER CONVERTER SECTION

The front end of the receiver uses two r.f. stages, the first a single neutralised TIS88 followed by a pair of TIS88s in a shunt cascode configuration. The choice of the shunt cascode was determined largely by the higher voltages per device that can be obtained. While a series cascode could have been used the roughly equal division of the available 12-13 volts supply would have meant that each device would only have about 6 volts of supply, a condition not conducive to the best results from FETs.

Double tuned circuits are used between the first and second r.f. stages and again between the second r.f. stage and the mixer. This method of coupling has been used to achieve an adequate band pass for use on the f.m. nets centred on 146 MHz., although there is no reason why the converter could not be centred on, say, 144.5 MHz. for a.m. work. In this case a normal tunable i.f. would be necessary.

† 54 Tennyson Street, Highett, Vic., 3190.
‡ 4 Elizabeth Street, East Brighton, Vic., 3187.

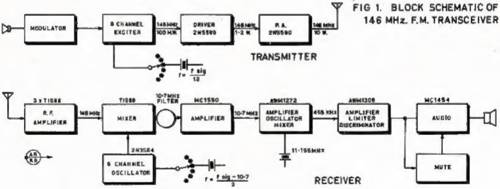


FIG 1. BLOCK SCHEMATIC OF 146 MHz. F.M. TRANSCEIVER

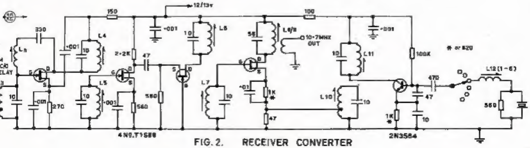


FIG. 2. RECEIVER CONVERTER

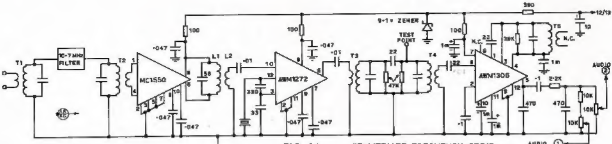


FIG. 3A. 'ERMEDIATE FREQUENCY STRIP

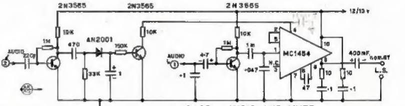


FIG. 3B. AUDIO AND MUTE

The mixer is a single TIS88 using low impedance injection from the oscillator into the source.

No dramatically new techniques have been used in the converter section of the receiver, but the resultant high performance and ease of alignment has been achieved only after much detail work on layout and circuit constants. The need to go through this (quite frustrating!) phase of development underlines the often forgotten maxim that at v.h.f. the circuit diagram alone is not a guarantee of success.

The six-band oscillator section is about as simple as it can be. A single 2N3564 uses third overtone crystals in the 45 MHz. range and triples into the collector tuned load. A second tuned circuit ⅜" away from the collector tank cleans up the injection waveform and is tapped to provide impedance transformation into the mixer source. Adequate injection voltage is available.

Crystal switching uses the tried and true rotary switch. Considerable work was done on a diode switching system, but it did not prove to be completely reliable under service conditions. The reasons for this are not fully known, but appeared to be tied up with the small (but finite and variable) resistance of the diode in its switched-on condition.

THE RECEIVER I.F. SYSTEM

It is in this part of the receiver that the most interesting technical developments have been used.

Input from the converter at 10.7 MHz. is applied to a Toyo Type 10M2A1 filter having a 3 dB. bandwidth of 30 KHz. and a passband ripple of less than 2 dB. Narrower filters were tried, but it was found that off-frequency and/or over-deviated stations were unintelligible. Note that the filter input and output transformers are supplied with the filter and are essential to its proper performance. The bandpass and shape of the passband on the four filters so far tried have been very close indeed to the individual calibration sheets supplied with each filter.

Output from the second filter transformer at low impedance is amplified in a conventional MC1550 stage whose output feeds an AWM1272 oscillator/amplifier/mixer device. This device is made by A.W.V. and has only recently become available.

Fig. 5 gives the internal circuitry of the 1272. It contains two Clapp type oscillators (only one of which is used in the receiver under discussion) and an emitter coupled balanced mixer. This one device has replaced the large number of discrete components used in some of the earlier experimental work.

Using a 10.7 MHz. input and a heterodyning crystal on 11.155 MHz. (or 10.245—it makes no difference) the output of the 1272 is on 455 KHz. Two standard Rapar miniature transistor i.f. transformers are used back to back to couple output into the AWM1306 stage. The two transformers are top coupled and resistively loaded to give optimum bandpass.

The 1306 is another multipurpose A.W.V. microcircuit. Its configuration and mode of operation were described in an excellent article by John Reynolds, VK3ZMU, in the June 1970 issue of "A.R."

Essentially the 1306 acts as an amplifier, a limiter and a quadrature detector and gives two audio outputs. In the Australis circuitry the second audio output is used to give a.f.c. and mute, but in the current design, a.f.c. is not used and a very simple mute circuit has been adopted.

The whole i.f./detector strip is run from a 9-volt zenered rail.

AUDIO AND MUTE

The audio section proper consists of a Motorola MC1454 IC to give a watt of output with an 8 ohm speaker. A very simple 2N3565 pre-amplifier is used to give some audio lift.

Muting is obtained as follows. Audio output from the 1306 is taken to the "tops" of two paralleled 10K potentiometers. One of these potentiometers acts as a normal volume control and feeds the audio pre-amplifier (Audio 1). The slider of the second potentiometer, the mute control, is taken to a second pre-amplifier (Audio 2) whose coupling capacitors emphasise the higher audio components. Amplified output from this stage is rectified and the resultant d.c. applied to the base of a third 2N3565. The collector of this transistor is connected to pin 4 of the 1454 via a 10K resistor.

With the mute control in the off position no d.c. is applied to the base of the 2N3565 switch and pin 4 of the 1454 is at its normal working level. As audio noise is applied to the pre-amplifier and rectified, the 2N3565 switch approaches the "on" stage. When "on" pin 4 of the 1454 is pulled down towards earth potential and cuts off the IC.

Some delay time is achieved by means of the 1.0 μF. capacitor immediately following the AN2001 noise rectifier.

GENERAL

The receiver as described has been in one writer's vehicle for a long shake-down period. While the signal generator says that the mute will open with less than 0.3 microvolt of input, the effect of this sort of sensitivity is only really apparent when used mobile over a long period of time under a wide variety of circumstances and over many different routes.

Suffice it to say that on the most used route (to work and back!!) copy has been consistently made from all parts of Melbourne when modified commercial units (both valve and transistor) have heard only noise.

Since the converter part of the receiver is that to be used in the next satellite for reception of 2 metre f.m. signals, the performance obtained augurs well for the future.

With the exception of two ICs, the p.c.b's, the filter and of course the crystal, no special components are needed and in fact those used were obtained ex stock through the VK3 W.I.A. components service.

Much interest has been shown in the development of this receiver and many

enquiries received for information on availability. P.c.b's are available in any case and, if sufficient demand exists, the authors will undertake to provide kits, instructions, etc. Those interested are asked to contact either author at the addresses given.

RECEIVER COIL DATA

I.F. Strip

T1—Supplied with filter.

T2—Supplied with filter.

L1—34 turns 29 B & S enamelled wire close wound on Neosid 722/1 former. Hot end to base of the former. F29 slug.

L2—8 turns 29 B & S, close wound over cold end of L1.

T3, T4, T5—Miniature 5-pin 455 KHz. i.f. transformers. ("Rapar 6" replacement i.f.t. from Radio Parts, Melbourne).

Converter

L3—4¾ turns 18 gauge tinned copper, 7/16" long on Neosid former, F29 slug. Tapped 2 turns from cold end. Cold end to top of former.

Ln—15 turns No. 22 B & S enamelled wire, close wound on Neosid former. F29 slug.

L4, L5—3¾ turns 18 gauge tinned copper, 7/16" long on Neosid former. F29 slug. Hot end to top of form.

L6, L7—As L4, L5 but cold end to top of former.

L8, L9—As L1, L2.

L10—5¾ turns 18 gauge tinned copper, 7/16" long on Neosid former. Tapped 2 turns from cold end. F29 slug. Hot end to top of the coil.

L11—5¾ turns 18 gauge tinned copper, 7/16" long on Neosid former. F29 slug. Hot end to top of coil.

L12 (1-6)—12 turns 26 B & S enam., close wound on Neosid former. F29 slug.

Note.—All coils wound in the same direction.

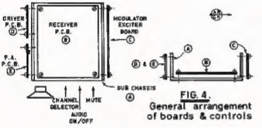


FIG. 4. General arrangement of boards & controls

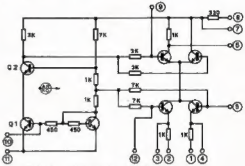


FIG. 5 AWM1272 SCHEMATIC

NEW CALL SIGNS

OCTOBER 1970

VK3KB—E. G. Mackay, 390 Upper Heidelberg Rd., Ivanhoe, 3079.

VK3QO—D. T. Bellair, 1 Mossman Dr., Heidelberg, 3084.

VK3AWX—S. Davies, 3 Laurens St., Rosebud, 3939.

VK3BCZ—B. G. Tideman, "Weller Lodge," 169 Canterbury Rd., Canterbury, 3126.

VK3BEK—C. E. Middleton, 7 Shamrock Ave., Cheltenham, 3192.

VK3YBB—J. E. McKenna, 14 Marshall Ave., Moe, 3825.

VK3YEG—A. H. Hambleton, 10 Sharrow Rd., Mitcham, 3132.

VK3YEI—L. N. Osborne, 18 Male St., Brighton, 3186.

VK3YEQ—B. J. Kemp, 1/17 Sydney St., Murrumbeena, 3163.

VK3YES—E. S. Rendell, 71 Broadway West, Yallourn, 3838.

VK3ZSR—A. C. Greening, 32/72 Altona St., Kensington, 3031.

VK3ZXR—J. E. Rising, 169 Centenary Rd., Melton, 3337.

VK4CU—C. V. Whale, 237 Newman Rd., Geebung, 4034.

VK4HI—H. D. McDougall, Station: 5A Rocky Point, Weipa, 4874; Postal: P.O. Box 23, Gordonvale, 4865.

VK4HJ—H. J. Simpson, 13 Clayton St., Ayr, 4807.

VK4RM—R. E. McDermott, Ridge St., Tewantin, 4565.

VK4ST—P. J. Weir-Smith, 19 Sourris St., Toowoomba, 4350.

VK4ZBJ—B. J. Riddell, 93 Harold St., Stafford, 4053.

VK4ZDI—G. J. Dickson, 4 Fullen Rd., Everton Park, 4053.

VK4ZMA—A. W. Manson, 39 Bellata St., The Gap, 4061.

VK5DK—C. M. Hutchesson, Yahl, via Mt. Gambier, 5290.

VK5QY—N. J. Kennedy, 26 Elizabeth St., Tea Tree Gully, 5091.

VK5TA—R. A. Couzens (call sign incorrectly advised as VK5AT in August list).

VK5ZTR—D. T. Rhodes, 3 Angas Crt., Modbury, 5092.

VK6DO—D. W. White, Station: U.S. Navcomsta, Exmouth; Postal: P.O. Box 30, Exmouth, 6707.

VK6EE—W. Schmitz, 16 Cowrie Cres., Mt. Pleasant, 6153.

VK6HK—D. E. Graham, 42 Purdon Rd., Wembley Downs, 6019.

VK6MD—M. D. Scott, Station: U.S. Navcomsta, Exmouth; Postal: P.O. Box 30, Exmouth, 6707.

VK7BC—C. F. Beech, McEwans Rd., Legana, 7251.

VK7CS—A. Szopko, Beach Rd., Legana, 7251.

VK7JM—J. W. McCulloch, "Tally Ho," Pitcairn St., Port Sorell, 7307.

VK7MA—P. M. Anderson, 21 Watchorn St., Launceston, 7250.

VK7NL—W. C. N. Larsen, 43 Upton St., Launceston, 7250.

VK8DW—D. W. Stephens, 55 Carruthers Cres., Alice Springs, 5750.

VK8ZSS—S. A. Stephens, 55 Carruthers Cres., Alice Springs, 5750.

CANCELLATIONS

VK3BL—D. Barney. Not renewed.
VK3KK—E. T. J. Kerby. Not renewed.
VK3MM—M. P. Marschall. Not renewed.
VK3MY—L. D. Money. Not renewed.
VK3AIP—E. F. Coate. Not renewed.
VK3AQO—D. T. Bellair. Now VK3QO.
VK3AUQ—F. D. Baarda. Not renewed.
VK3BAE—C. Lindsay. Not renewed.
VK3BCT—R. D. Trickett. Now VK9BT.
VK3YDF—J. E. Falkner. Now VK2BDP.
VK3YEJ—J. E. Rising. Now VK3ZXR.
VK3YEM—J. E. McKenna. Now VK3YBB.
VK3ZDM—R. J. Beames. Not renewed.
VK3ZLO—R. W. Davis. Not renewed.
VK3ZSQ—C. E. Middleton. Now VK3BEK.
VK3ZUM—E. G. Mackay. Now VK3KB.

VK4CY—H. R. Greber. Not renewed.
VK4RC—Brisbane Amateur Radio Club. Not renewed.
VK4TZ—A. E. Taylor. Transferred to S.A.
VK4ZEG—E. F. Gill. Transferred to T.P.N.G.
VK4ZGZ/T—A. W. Reynolds. Transferred to N.S.W.
VK4ZHJ—H. J. Simpson. Now VK4HJ.
VK4ZPM—P. J. Weir-Smith. Now VK4ST.

VK5AD—B. C. Jellett. Not renewed.
VK5GO—F. D. Voight. Transferred to Vic.
VK5OD—Open Door Radio Club. Not renewed.
VK5ZKR—C. M. Hutchesson. Now VK5DK.
VK5ZOK—N. J. Kennedy. Now VK5QY.
VK6DM—D. M. McGlinsey. Not renewed.
VK6ZBB—W. E. Olson. Not renewed.
VK6ZCR—C. C. Stables. Deceased.
VK7IE—I. L. Eadie. Transferred to Vic.
VK7ZBJ—B. J. Riddell. Now VK4ZBJ.
VK7ZCS—A. Szopko. Now VK7CS.
VK8AB—B. C. Jellett. Not renewed.

☆

LICENSED AMATEURS IN VK

SEPTEMBER 1970

	Full	Lim.	Total	
VK0	10	0	10	
VK1	82	31	113	
VK2	1408	461	1869	
VK3	1309	631	1940	
VK4	525	194	719	
VK5	520	235	755	
VK6	359	141	500	
VK7	160	72	232	
VK8	33	11	44	
VK9	91	8	99	
	4497	1784	6281	Grand Total

OCTOBER 1970

	Full	Lim.	Total	
VK0	10	0	10	
VK1	82	31	113	
VK2	1408	461	1869	
VK3	1305	632	1937	
VK4	527	193	720	
VK5	519	234	753	
VK6	362	139	501	
VK7	164	74	234	
VK8	33	12	45	
VK9	91	8	99	
	4501	1780	6281	Grand Total

Modification to the Mute Circuit of the Pye Mk. 2

RODNEY D. CHAMPNESS, VK3UG*

The original muting circuit of the Pye Mk. 2 v.h.f. a.m. transceiver leaves much to be desired in its method of operation as undoubtedly owners of this particular model have found out. The trouble comes about through the use of a relay to switch the speaker on and off. It is a well known fact that a relay requires a much higher current to pull it in than to drop it out. In other words, the relay may require 10 mA. to pull it in, but the current may have to drop to 5 mA. before it drops out again, which actually means in the case of the Pye Reporter that the muting must be much harder than desirable, causing weak signals to be missed, for the convenience of having muting during no-signal times. This used to cause me to miss many of the weaker signals, much to my annoyance.

Having put up with this defect for some time, I decided some form of fully electronic mute was most desirable. I came across the circuit that follows in an American magazine. I have modified it slightly so that it will suit the Pye. The original circuit required no extra valves, but this can only be so when the set has simple a.g.c. or only a slightly delayed a.g.c. system. The original circuit used the variation in the screen voltage of one of the a.g.c. controlled r.f. or i.f. stages, as shown in the second diagram, to operate the muting circuit. I won't describe the original American circuit, just the one suitable for the Mk. 2—it will suit, of course, the Mk. 1 and Mk. 3 with the addition of a small triode such as a 6C4.

To convert the Mk. 2, first of all, get rash and remove all the muting circuit, including the relay, wiring the speaker line direct from the transformer to the speaker. Having done all these drastic alterations, you will now find you have quite a bit of space about the 12AT7 socket. Just wire it as per circuit diagram and away it should go.

The principle of operation is quite simple. With no signal input, V1 will have no bias and will be conducting as much as it is able, the 100K (R6) restricting the total current to a quite reasonable level. As a result of this, the anode of the OA202 will be negative in respect to the cathode and it will be cut off, which means that it is an effective switch between C3 and C4 so the set is effectively muted, providing of course that VR1 is set so that this condition does apply.

Should your valve be a bit different to mine, R4 and R7 can be juggled to get a voltage at the earthy end of VR1, which is slightly less positive than the voltage at the plate of the valve. This will mean that the diode is conducting and the set is unmuted as the diode will act as a small series resistor between C3 and C4. As the slider on VR1 is advanced towards the positive unearthed end, the diode will become reverse biased and the set muted.

When a signal comes in, a negative bias is developed across the detector load and this is applied to the grid of V1 causing it to gradually cut off which means that depending on the setting of VR1 the set will unmute at a set pre-determined signal level. It might be noted that the set can be made to unmute on signals which have not even actuated the d.a.g.c. I can hear signals now that I couldn't previously and the mute closes quickly and positively after every received transmission.

You may think that R1, R2, C1 and C2 are unessential for this job, but I can assure you that this is not so. The 12AT7 will act quite effectively as an audio valve and cause the diode to open and close at an audio rate. Mostly this caused the residual noise to leak through, in fact, all the noise that the noise limiter removes is being amplified by this circuit as it comes before the noise limiter. These four components are used as an audio filter so that only pure d.c. is supplied to the 12AT7.

C5 is optional and is inserted to back up the aforementioned components to suppress audio leakage.

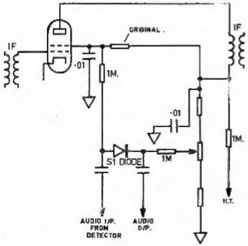
There is only one defect with this circuit that I have noted which should be able to be corrected. This defect is that if there is a quite high noise level, say ignition, etc., the mute will open, giving you a large dose of noise that can be well done without. I have thought of an addition to this circuit which may work. It consists of a small value capacitor of a 100 pF. or thereabouts possibly, followed by a diode and a series resistor as shown on the diagram dotted in. The theory behind this being that the noise pulses are much higher in frequency than the average audio. These are rectified in this circuit and applied to the grid of the 12AT7 to hold it fully conducting to counteract the negative voltage developed by the audio detector. The values of this addition would need to be played with to get the desired effect.

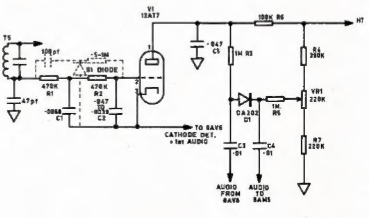
I have used this mute circuit on a couple of sets and in both, the result has been very successful and I feel I can recommend it. It would undoubtedly be quite suitable to use in other valved a.m. equipment, h.f. or v.h.f. This mute does not give an entirely quiet receiver as there is still a small amount of high frequency audio leakage across the capacity of the diode, but this is of such a low amount that it is of no consequence.

The value of C2 can be varied quite a bit to give slower response to incoming signals and particularly noise pulses. A suggested upper value could be about 0.047 μF.

One precaution: With the mute hard on, the back bias on the OA202 must not exceed 150 volts or the diode may break down.

* 24 O'Dowds Road, Warragul, Vic., 3820.





Australis-Oscar 5 Spacecraft Performance*

By JAN A. KING, W3GEY

In the rather brief lifetime of the Australis-Oscar 5 experiment a number of useful experimental and operational results have been achieved. The satellite was launched on 23rd January, 1970. As of this writing, 211 formal reports have been received from 27 countries around the world on both telemetry and propagation results. Many other stations were known to have received the satellite, but did not submit quantative data.

Based on reports received, here is a summary of the performance of each system on the AO-5 spacecraft:

THERMAL BEHAVIOUR OF AO-5

The temperature of AO-5 at ejection from the second stage of the Delta vehicle was 20°C. despite its proximity to the second stage engine and a very cold nitrogen gas jet during launch. The temperature, however, began to rise during orbits 1 through 10 and then stabilised internally at 43°C. ±3°C., where it remained for the duration of the satellite's useful life. This temperature is fairly high, although it is within the design temperature range of 19° to 45°C. The effects of this higher temperature were, unfortunately, all adverse. Battery lifetime was somewhat shortened during the initial phase of discharge; but worse than this, the 144.05 MHz. beacon power dropped off faster with decreasing supply voltage due to the decreased efficiency of the r.f. power output transistor.

External temperature measurements were higher in sunlight and cooler during eclipse periods as observed by many reporting stations. As the spacecraft entered the dark portion of the orbit the skin temperature dropped from its 55°C average to 42°C. ±3°C. The internal temperature, however, remained fairly constant, dropping only two to three degrees during the entire eclipse period. Acknowledgment is due to Bill Armstrong, W0PG, John Fox, W0LER, Nastar, K2SS, and others for their data in this area.

The spin rate about the X-axis in later orbits became quite slow so that the skin sensor located on the +Y surface showed changes in temperature as parts of the satellite rotated in and out of its own shadow. This data was most useful in determining the roll rate about the stabilised axis of the spacecraft. John Goode, W5CAY, reported this data for many orbits between 100 and 250 Skin temperature data indicated a spin period of 7 to 8 minutes about the X-axis after the initial 100 orbits. An example of this data is shown in Fig. 1 for orbits 168, 205 and 206, along with horizon sensor data.[1]

THE AO-5 POWER SYSTEM

The spacecraft battery voltage decreased with time faster than predicted by pre-launch testing of individual cells (see Fig. 2).[2] It is now known that the accelerated battery discharge was caused by two factors. First, the higher satellite temperature accelerated the normal chemical reaction in the alkali-manganese batteries. Secondly, an additional 18 mA. of current was attributed to a failure of the 10 metre modulator that occurred on orbit 3. It was verified that the 18 mA. was independent of the ten metre transmitter itself by commanding the transmitter off and observing that the extra current was still present. The ten metre modulation failure has also been attributed to the higher spacecraft temperature.

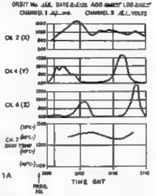


Fig. 1A

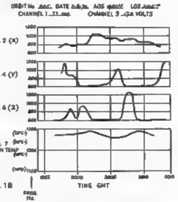


Fig. 1B

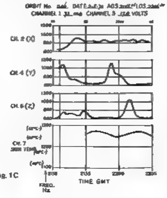


Fig. 1C

MAGNETIC ATTITUDE STABILISATION SYSTEM AND HORIZON SENSORS

One of the best operating systems on board the satellite was not electronic in nature. The Magnetic Attitude Stabilisation System (MASS) functioned more efficiently than some of us had anticipated. Early reports indicated that antenna nulls were occurring on the 144.05 MHz. signal once every 15 seconds, making telemetry decoding very difficult. By orbit 100, signal fades had reduced to one or two per station pass (approximately 20 minutes in duration). To the Amateur using the spacecraft this is a significant improvement over past satellites in the Oscar series and should prove to be a valuable tool in future Amateur spacecraft to achieve the continuous reception of a down-link signal.

The three orthogonal earth or horizon sensors used in the spacecraft were 2N2452 photo-transistors operated in a diode mode, having a spectral response between 5,000 and 10,500 A.[3] Each sensor's field of view had been stopped to 5 degrees by a small columation tube. A photometric calibration of these sensors was, unfortunately, not undertaken due to the shortage of time in the test schedule. While the original design of this part of the telemetry system was to give an on-off indication when looking toward or away from the bright earth, the devices were found to be more sensitive and capable of detecting the decreasing brightness of the earth's atmosphere as the sensors viewed the earth-to-space transition.

When viewing the bright earth the telemetry output indication was approximately 1450 Hz. and during the transition the telemetry frequency gradually decreased to a dark condition of 600 Hz.

Amateurs using a fast discriminator to decode the modulation observed, during periods of good signal strength, small variations in the frequencies of the telemetry tones as the sensors swept across the earth's disc. These were attributed to cloud formations.

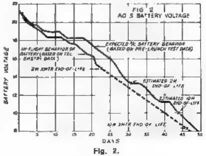


Fig. 2.

* Reprinted from "QST," December 1970.

Two examples of this data are shown in Fig. 3

With a discriminator of this type, the Goddard Amateur Radio Club, WA-3NAN, decoded telemetry information for all the passes received.[4] Fig. 4 shows horizon sensor information for various passes. Each frame shows the maximum rate of change of brightness observed on any of the sensors during a given pass. During orbit 4 the maximum observed rate of frequency change was found to be 700 Hz. per second, while pass 192 exhibits a maximum rate of change of only 10 Hz. per second. This is indicative of the reduced spin rate of the satellite.

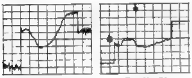


Fig. 3.—Two examples of variations in the plus-Y sensor output due to variations in the earth's brightness. Note the sudden increase and decrease in intensity during the frame from pass 54. This is thought to be due to the sensor sweeping across a bright cloud region. Time divisions are 1 sec.

During daytime ascending nodes, after the spacecraft had stabilised, a regular sensor pattern was observed. W5CAY demonstrated this data most effectively (see again Fig. 1). The X-axis shows no true periodic nature, but rather a gradual transition followed by small variations about an average "light" condition. The Y and Z sensors show a periodic behaviour characteristic of the satellite's roll rate about the stabilised X-axis. The skin temperature shows a cyclic variation as the +Y face rotated in and out of the spacecraft's own shadow. Of particular significance is to observe that the Z sensor always lags behind the Y sensor (approximately two minutes) in detecting the earth. With the +X-axis pointing north as the satellite crossed the equator, the spacecraft spin was thus clockwise as observed from the north pole of the earth.

The maxima in the external temperature curve were (within experimental error) out of phase with the +Y sensor. Since the T_{EXT} thermistor was located on the +Y face, then the temperature was a minimum during times when the +Y face was viewing the earth. This is, in fact, the time when the +Y face should have been in shadow.

As the spacecraft travelled north from the equator the +X-axis should have begun to dip toward the earth as the strong dipole moment of the satellite (11,800 pole-cm) followed the local geomagnetic field vector which caused it to rotate twice per orbit (see Fig. 5).[5] W5CAY's data showed that the +X-axis sensor did begin to gradually come on shortly after his signal acquisition time over a period of several minutes. This is precisely what one would have predicted as the +X sensor looked deeper into the earth's atmosphere which reflected more and more scattered light into the sensor.

Region	Stations Reporting Useful Data	Stations Reporting Telemetry >50% of Passes	Stations Reporting Telemetry <50% of Passes
1	66	52%	48%
2	114	32%	68%
3	31	45%	55%

Table 1.

The average roll period observed in this data is 7.5 min. This is thought to be the degree of stabilisation that persisted until the termination of the satellite's active life. The effectiveness of this system is best evaluated in terms of the very large reduction in the signal fading rate due to antenna nulls. This, in turn, implies an overall reduction in the loss of spacecraft data. For a satellite in the Amateur Radio Service it is apparent that this method of stabilisation is most effective and very easily implemented.

THE AO-5 COMMAND SYSTEM

A telecommand link on two metres was utilised to turn on and off the ten metre beacon transmitter in an effort to conserve the spacecraft's power supply. An a.m. tone modulation technique was employed. The ten metre beacon which consumed 0.8w of power, was to be commanded on during weekends when a maximum number of users was anticipated.

Prior to launch, considerable difficulty was encountered with the spacecraft command receiver due to in-band interference from the 144.05 MHz. beacon transmitter. It was only possible to eliminate the interference by adding a steep skirted bandpass filter centered at the command frequency. This filter gave 50 dB. of rejection at the beacon frequency, but unfortunately had a relatively high insertion loss when placed in front of the receiver. The result was that the command receiver required a signal of —76 dBm. (35.4 μV.) under ambient (room) conditions to decode a command. This, to be sure, was considered marginal performance.

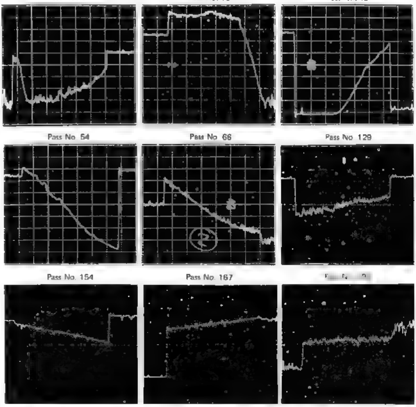


Fig. 4.—The maximum rate of change of the horizon sensors during limb transit on for various passes of AO-5. The data shows a gain factor of 70 in only 15 days. This is a particularly graphic demonstration of the effectiveness of the stabilisation system. Time divisions are 1 sec

The problem was further complicated by a detuning of the second i.f. stage that occurred during tests under vacuum conditions. This problem could not be traced to a single component in a timely fashion so it was decided to peak the receiver for maximum sensitivity under vacuum conditions. When the receiver was again tested under vacuum conditions the sensitivity was observed to be 10 dB. better. Thus, it was expected that the in-flight sensitivity would improve some 10 dB. over its ambient condition, giving a final sensitivity figure required to operate the decoder of —86 dBm The spacecraft was launched with the receiver in this condition.

Fig. 6 shows a plot of the spacecraft total current during the entire lifetime of the two metre beacon, when telemetry data could be obtained.* From this data it is clear when commanding occurred and the status of the ten metre beacon during the lifetime of the satellite.

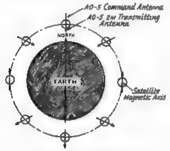


Fig. 5.—Motion of a magnetically oriented satellite in a polar orbit.

Table 3 lists the command transmitter schedule, indicating the successfully transmitted commands and the effective radiated power used to execute the command. Although early command attempts were unsuccessful, after orbit 72 it became increasingly less difficult to achieve a successful command and it became possible to maintain the week-end-only operation schedule for the ten metre beacon as originally planned. It is felt that the increased overall sensitivity of the command system was due to a combination of factors:

(a) Spacecraft command antenna orientation favourability (particularly over Australia, due to the effectiveness of the magnetic attitude stabilisation system).

(b) Reduction of the interfering signal level (144.05 MHz.) as the battery voltage (and hence the power of the beacon) decreased.

(c) Stabilisation of the command receiver temperature and pressure which improved the sensitivity of the receiver.

The effectiveness of the command system, particularly despite the receiver problems, is of particular significance to future Amateur space experiments. It not only demonstrated, for the first time in an Amateur satellite, the effectiveness of ground command as a means of switching various experiments on and off, but of greater significance, it represents an effective means of controlling Amateur spacecraft emissions so as to prevent interference to other services who may share the Amateur bands. This should help assure the continuing usage of Amateur space experiments without the need for power flux limitations imposed on the satellite down-link signal.

SPACECRAFT LIFETIME

As previously indicated, the failure of the ten metre modulator is considered responsible for the increased battery current drain of 18 mA. This additional current drain shortened the lifetime of the satellite. The two metre beacon could be received through approximately orbit 280 on the 23rd day after launch. The ten metre beacon was turned on by command on orbit 261 and was left on continuously until it reached end of life around orbit 560 on the 46th day after launch. The difference in beacon lifetimes is due to the variation in cut-off voltage for the transmitters. The two metre transmitter power output went to zero very rapidly at a supply voltage of 15v., while a significant output could be obtained from the ten metre transmitter even at voltages as low as ten volts. While the spacecraft lifetime on two metres was shorter than the design lifetime of thirty days, a significant quantity of telemetry data was obtained never the less.

THE NATURE AND RELIABILITY OF AMATEUR REPORTS

An additional feature of the AO-5 experiment was the opportunity to evaluate the performance of Amateurs in reporting scientific-type data. After allowing several months to be certain that all late reports had been received, an effort was made to determine what type of information Amateurs were most interested in reporting and approximately how much variation in measurement occurred from station to station.

It was decided to report on the results by I.T.U. regions since different satellite passes were common to these regions, i.e. Region 1 (Europe and Africa) could generally not hear the same passes as Region 2 (North and South America) and so forth. Table 1 lists the number of useful reports received from each region and those which did and did not contain telemetry information. We may infer that stations not reporting telemetry results were primarily interested in other aspects of the experiment or in phenomena such as Doppler measurement. (Only the telemetry results are covered in this report since they were the primary indicator of the spacecraft performance. Another report prepared by Raphael Soifer, K2QBW, gives a detailed presentation of the ionospheric propagation results of AO-5.*)

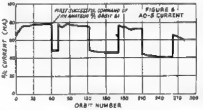


Fig. 6.

Call Sign	Channel 1 I(mA)	Channel 3 V(volts)	Channel 5 Tint (C°)	Channel 7 Text (C°)
Region I Pass 51				
G2AOX	72	19.4	38	49
F2DC	80	20	43	55
HB9WB	73	19.6	43.5	47
Δ Values	8	0.6	5.5	8.0
Max.% Error from median	5.3%	1.5%	6.8%	7.9%
Insufficient data from Region I. Telemetry reports have not yet been received.				
Region II Pass 17				
WA1IOX	78	20.2	44.5	51
K2SS	78	20.1	45	54
WA3NAN	78	19.8	45	54
WØLER	77	20.5	45	52
W5CAY	77	20	44	53
W3GEX	78	20	—	52
W3QVG	74	20	—	51
K4CG	76	20.4	45	53
WA7GCS	76	20	43	47
W2GAX	76	20	44	53
W1AIM	70	20	40	48
K1OYB	76	20	44	52
K3AKR	—	20	—	51
K1HTV	79	20	46	49
W1JSM	82	20	49	60
Δ Values	12	0.7	9	11
Max.% Error from median	7.9%	1.7%	9.9%	10%
Region III Pass 21				
VK3ATN	78	20	43	49
ZL1WB	80	20	46	48
VK3AVF	70	20	42	46
ZL3TAU	76	20	42	47
VK5KK	79	20	43	45
ZL2TAR	75	20	41	45
VK7PF	75	20	42	48
VK4ZT	78	20	43	48
Δ Values	10	0	4	4
Max.% Error from median	6.7%	0%	4.7%	4.3%

Table 2.

Table 1 indicates that, on a percentage basis, Region 1 and Region 3 participated more actively in the telemetry decoding activities. This is somewhat surprising, since it was anticipated that U.S. Amateurs would be suitably equipped to make telemetry measurements.

It was of interest to determine the variation in measured values from as many stations as possible during a single pass. Variation in spacecraft parameters for a short period when the satellite passed over a given region, was thought to be quite small (except for skin temperature variation) during daylight passes. The variation in data from reporting stations, then, can be primarily considered as individual station measurement error. In each region a particular pass was chosen for which a maximum number of reports was received.

Table 2 shows data for each station reporting and the range in data as well as the maximum percent. of error from the median value The error observed for the spacecraft battery voltage shows the lowest error due to the relatively "flat" nature of the voltage-to-frequency conversion curve and the fact that most of those reporting rounded off the reported measurement (as called for by the telemetry reporting form). Certain stations (those underlined) were used as control stations for each region since they were known to have better than average decoding equipment.

All regions show comparable data error. The magnitude of the error (less than 10% max.) was approximately the error estimated prior to the launch. This data does not utilise more powerful statistical methods that could be used to more accurately evaluate the data (i.e. a uniform probability density was assumed for all data). The maximum error figure of 10% does indicate that Amateurs throughout the world are capable of making significant data measurements with considerable accuracy

SUMMARY

With the exception of a failure in the modulator of the ten metre beacon transmitter, all Australis-Oscar 5 mission objectives were met:

(a) The spacecraft was effectively stabilised to two revolutions per orbit (geometric alignment) within the lifetime of the satellite.

(b) Reliable Amateur spacecraft telecommand was demonstrated.

(c) The effectiveness of the seven channel telemetry system was verified. Amateur data generally showed less than ±10% variation from median values.

(d) Significant results were obtained on propagation effects over the satellite-to-earth link in the ten metre band.[7]

(e) Partial success was obtained in achieving the design lifetime of several weeks for both spacecraft transmitters using only chemical batteries.

While the response to AO-5 was gratifying (many stations reported it to be the most interesting Amateur space activity to date) it does not compare with the level of excitement that was generated by the repeater satellites such as Oscar III. AMSAT is presently planning a next generation of Oscars. These satellites will carry two repeaters and an r.t.t.y. telemetry system capable of measuring as many as 60 parameters. The design lifetime of these satellites will be one year, using a solar cell power source. Whether you are interested in r.t.t.y., f.m., a.m., s.s.b., DX traffic handling, or even contesting there are activities and special experiments being planned for you with Oscar 6. If you are interested in finding out how you can contribute to this new and exciting chapter in Amateur Radio write: AMSAT, P.O. Box 27, Washington, D.C., 20044, U.S.A.

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2. Date taken from Australis-Oscar 5 (A Summary Report) submitted to AMSAT by John Fox, W0LER.
3. Data taken from Fairchild Semiconductor Specification information on the 2N986/2N2453 NPN Planar Phototransistor, 5/62.
4. Information taken from preliminary data reduced at the Goddard Space Flight Centre, NASA, by the Goddard Amateur Radio Club, 4/70.
5. Fischell, Robert E., "Magnetic and Gravity Attitude Stabilisation of Earth Satellites," Report CM-996, John Hopkins Univ Applied Physics Labs., May 1961, p. 38.
6. Op. Cit., John Fox, W0LER.
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8. Op. Cit., Soifer.

Command Number	Station E.R.P.	Station Commanding	Date	Orbit Number	Purpose of the Command (Other Comments)
1	10 KW.	WA1IOX (U.S.A.)	1/28	61	10M Beacon off (first command of Amateur S/C)
2	20 KW.	VK3ZBJ (Aust.)	1/29	72	10M Beacon on
3	10 KW.	VK3ZBJ (Aust.)	1/31	97	Command Receiver Freq. Check (Beacon off, on; off, on)
4	20 KW.	VK3ZBJ (Aust.)	2/2	123	10M Beacon off (routine)
5	10 KW.	VK3ZBJ (Aust.)	2/6	172	10M Beacon on (routine)
6	10 KW.	VK3ZBJ (Aust.)	2/9	210	10M Beacon off (routine)
6	20 KW.	VK3ZBJ (Aust.)	2/13	260	10M Beacon on (last command during S/C lifetime)

Table 3.

☆

"CQ" W.W. W.P.X. S.S.B. CONTEST, 1971

PRECIS OF RULES

Date 27th/28th March.

Time Start 0000GMT Saturday, finsh 2400 GMT Sunday Only 30 hours out of the 48 hours are permitted for single operator working. The 18 hours of rest may be taken in up to five periods during the contest and such periods must be logged.

Bands: 1.8 to 28 MHz.

Mode. Two-way s.s.b. only.

Exchange. RS report plus three digit contact number commencing with 001.

Scoring QSO Points—

	1.8 to 7 MHz, inc.	14 to 28 MHz, inc.
Between stations on different continents	6	3
Between stations in the same continent but in different countries	2	1

QSO between stations in the same continent and in the same country are permitted for multiplier purposes only.

Multiplier: Determined by the number of different prefixes worked. A prefix is considered to be the two or three letter/number combination which forms the first part of an Amateur call, e.g. W1, K1, WA1, 4X4, 4Z4. Each prefix may be counted only once during the test.

Total: Single operator, single band—QSO points multiplied by the number of different prefixes worked: single operator, all band—total QSO points from all bands multiplied by total number of different prefixes worked N.B.—A station may be worked once on each band for QSO point credit. However, prefix credit can be taken only once regardless of the band.

Awards. In each category for each call area of Australia. To be eligible for a single band award the log must contain a minimum of 12 hours of operation.

Log entry Logs to be postmarked no later than 1st May, 1971, and addressed to "CQ" W.P.X. S.S.B. Contest Committee, 14 Vandeventer Ave., Port Washington, Long Island, N.Y., U.S.A., 11050.

Note: Complete rules are published in recent issues of "CQ" magazine.

PROVISIONAL SUNSPOT NUMBERS

DECEMBER 1970

Dependent on observations at Zurich Observatory and its stations in Locarno and Arosa.

Day	R	Day	R
1	66	16	65
2	69	17	60
3	75	18	70
4	65	19	88
5	65	20	101
6	79	21	93
7	86	22	90
8	97	23	76
9	87	24	63
10	95	25	69
11	101	26	61
12	95	27	50
13	71	28	47
14	82	29	50
15	81	30	71
		31	65

Mean equals 76.6.

Smoothed Mean for June 1970: 105.1.

Predictions of the Smoothed Monthly Sunspot Numbers

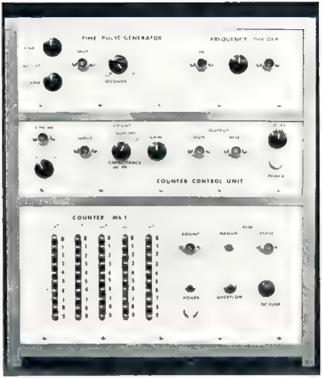
January	85	April	79
February	83	May	77
March	81	June	75

—Swiss Federal Observatory, Zurich.

COUNTER USED FOR FREQUENCY MEASUREMENT

PART TWO— GATING, DISPLAY TIME, RESET

ROBERT H. BLACK, M.D., VK2QZ*



Completed Frequency Meter. The second regulated power supply is contained in the "Counter Control Unit".

The previous article in this series introduced the element of time as a first step towards measurement of frequency. I'm not sure what time is, especially these days, since the International Committee of Weights and Measures have been playing around with it (see Sheldon and Evans, 1965). However, for our purposes, something related to WWV or VNG was sufficient.

We are concerned with counting pulses over a standard interval of time and displaying the count for sufficient time for it to be read. The counter is reset to zero after each count and the process can be repeated over and over. The display will be apparently continuous if the time intervals are short enough (1/100th second), but shortening the counting time results in the loss of significant digits

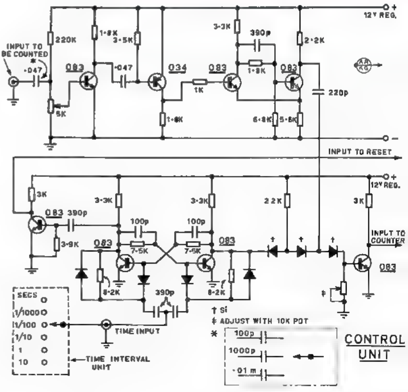
The circuit diagram shows a control unit which, in effect, produces batches of pulses for counting which are separated by time intervals for visual display followed by appropriate reset pulses. The unit also allows some amplification of the input signal which is converted to a series of positive pulses by means of a Schmitt trigger. The input amplifier could readily be elaborated and some overload protection provided. However, it is sufficient for present needs.

The gated amplifier is alternatively opened and closed by the time-pulse operated bistable. The best operating condition is found by adjusting the bias with a potentiometer which is later replaced by an appropriate fixed resistor. The input to the gate from the Schmitt trigger is a little weird and, no doubt, a more orthodox arrangement could be made to work. Note that the diodes in the gate circuit are silicon diodes—these can be differentiated from germanium diodes because they require a slightly higher voltage before they start to conduct.

Equal count and display times are obtained when the reset pulse is taken directly from the time-pulse operated bistable. The version shown in the photograph includes an additional monostable in the reset circuit which sets the counter to zero an appreciable time before counting of the next batch begins. No real advantage was derived when this was included.

The time pulses are derived from the unit already described. Two binary counters, arranged as decade dividers, are actually included in the Control

(Continued on Page 15)



*2 Yerton Avenue, Hunter's Hill, N.S.W., 2110.

SOLID STATE CONVERSION OF THE G.D.O.*

Circuits for modernising your Grid-Dip Osc. to obtain greater flexibility and sensitivity

PETER A. LOVELOCK, W6AJZ

The grid-dip oscillator is one of the most useful items of test equipment to have around the Amateur station. The main short-coming of most tube-type g.d.o's is their requirement for a.c. power. This is no problem at the work-bench, but it is a definite limitation for portable or mobile work. Anyone who has used a g.d.o. to tune an antenna knows what a chore it can be to run an a.c. power extension line up a tower —not to mention the safety hazard.

Today's catalogues offer a selection of solid state "dippers" in an attractive price range. They have the advantage of being usable anywhere. If you already have an older g.d.o., you may have considered trading it in for one of the contemporary models, or maybe even building a solid state unit from scratch.

A simpler and much cheaper solution is to convert your tube g.d.o. to a solid state circuit. If you are reluctant about tearing into a commercially built unit or kit—don't be. The conversion task is simple, painless, and can be done in an evening. The result will give you the performance and flexibility of the latest models at a fraction of the cost.

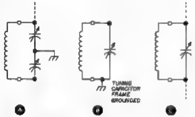


Fig. 1.—Typical tuned circuits used in g.d.o.'s. Split-stator tank is shown in A; parallel grounded and parallel ungrounded versions in B and C.

THE TUNED CIRCUIT

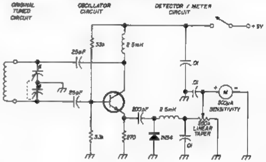
Before you reach for the soldering iron, inspect your tube-type g.d.o's schematic. The tuned circuit will influence your decision on the solid state circuit to use. You'll want to keep the tuned circuit intact as well as the dial calibration. Thus, you won't have to change your plug-in coils.

The g.d.o. is nothing more than a simple oscillator. In tube types, the rectified grid current is measured on a meter to indicate a "dip" when power is absorbed from a nearby resonant circuit. Solid state devices don't have grids, or course, so an indication on a solid state g.d.o's meter is obtained from the oscillator's rectified output. The basic operating principle is the same in both circuits.

Common tuned tank circuits used in commercially built g.d.o's are shown in Fig. 1. Your schematic will show if your unit has a split-capacitor, parallel-grounded, or parallel-ungrounded tank. This will determine the type of solid state circuit you can use.

For the solid state device, you have a choice of a bipolar transistor, FET, unijunction transistor, or tunnel diode. All give good performance with minor variations. For simplicity, only the first two are considered. However, if you have a favourite unijunction diode circuit you might try it. Your final decision will probably be based on what's on hand.

Fig. 2.—Solid state g.d.o. with split-stator tank. A PNP transistor could also be used by reversing battery polarity.



NPN OR PNP CIRCUIT

An NPN transistor circuit I used in converting a Heath model GD-1B, which has a split-stator tank, is shown in Fig. 2. This circuit worked well with many transistors, including the 2N2926 and 2N706, up to 200 MHz.

A PNP transistor may be used in the same circuit if you reverse the battery polarity. In both cases oscillator output was more stable than in the original tube circuit. Less frequent adjustment of the sensitivity control was required during measurements.

COMMON-BASE CIRCUIT

If your tube g.d.o. has an ungrounded parallel tank, the common-base circuit shown on page 442 of the R.C.A. Transistor Manual, Series SC-12 (reproduced in Fig. 3) is suitable.

FET OSCILLATOR

The circuit I finally used to convert my Heath GD-1B is shown in Fig. 4. Advantages over the circuit in Fig. 2 are fewer components and greater sensitivity in obtaining a dip. This circuit requires a higher voltage supply, however. I used two 9-volt transistor batteries in series to obtain full-scale meter deflection over the instrument's range.

Since it is impractical to illustrate all the applicable circuits for g.d.o. conversion, I've included a list of articles in the references that should contain circuits you can use.

CONSTRUCTION

After you have selected a suitable circuit, you are ready to start construction. Remove all the original oscillator and power supply components (if any) and their wiring. Don't remove the tuning capacitor, coil socket, meter or sensitivity control. Take care not to disturb the wiring between the tuning capacitor and coil socket.

The logical spot for the transistor is that vacated by the tube. You can mount a transistor socket on an adaptor plate placed over the tube socket hole. If you don't like transistor sockets, cut and drill a small piece of perforated board and mount it over the tube socket hole. Flea clips inserted in the board will allow permanent soldering of the transistor—but don't do this until all other components are mounted.

After assembling and wiring the components, temporarily attach the transistor leads to the flea clips with-

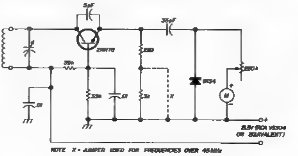


Fig. 3—Common-base g.d.o. circuit reproduced from R.C.A. Transistor Manual.

* Reprinted from "Ham Radio," June 1970.

out soldering. This allows preliminary checkout.

Component leads must be kept short, particularly those connected directly to the transistor and the tuned circuit.

Small-value capacitors should be high grade silver mica. Bypass capacitors should be ceramic, **not** paper, to avoid stray resonances in the oscillator. All resistors are composition type, ¼ or ½ watt.

The battery may be mounted in the space previously occupied by the power supply, using an appropriate bracket for the type of battery suited to your voltage and space requirements. Be sure to wire the battery connector with the **correct** polarity for NPN or PNP transistors.

In the circuits shown in Figs. 2 and 4 the sensitivity control is a 250K, linear-taper potentiometer. If your g.d.o. uses a lower value, I suggest replacing it with a 250K potentiometer and an s.p.s.t. switch to control the battery power.

CALIBRATION

Finally, check the dial calibration by beating the oscillator against a good communications receiver. Calibration may be a bit off if stray capacitances of the new circuit vary from the original. While most dippers are only approximately calibrated, you will want to maintain reasonably accurate calibration. Loosening the dial-locking screw and re-adjusting its position relative to the tuning capacitor will take care of most cases. However, if the calibration error exceeds this method of correction, or if the error occurs only on certain coils, the following tips will help.

Sliding a one-half inch strip of aluminium foil over two or three turns of the coil will lower its frequency. Conversely, a single shorted turn of wire placed around the form will increase the coil's frequency as you slide it toward the coil. Fig. 5 illustrates these methods. After calibration has

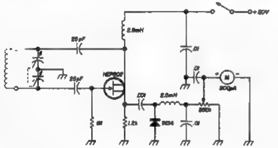


Fig. 4.—Grid-dip oscillator using an FET. This circuit provides greater sensitivity with less coupling because of FET's high input impedance.

been adjusted, the shorted turn or foil strip may be permanently cemented in place.

CHECKOUT

After wiring and carefully checking the circuit, install the battery and transistor. Plug in a coil, apply power, and turn up the sensitivity control. If you don't get a meter reading, the circuit isn't oscillating or you forgot to use a heat sink when soldering the diode rectifier.

Assuming you obtain a reading, increase the control for full-scale meter indication and tune the capacitor from minimum to maximum to check for full-scale readings over the entire range. Repeat this for each coil. If any false dips are noted without the coil coupled to another circuit, you have a "built-in" resonance. Most likely this will occur on the higher frequency coils (40 to 200 MHz.) if lead lengths are too long or if non-resonant bypass capacitors were used.

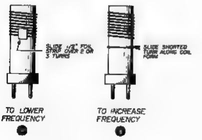


Fig. 5.—Methods for adjusting g.d.o. coils for calibration correction.

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2. Calvin Sondergoth, W9ZTK, "Transistor Oscillators," "73" March 1969.
3. J. R. Fisk, W1DTY, "Designing Transistor Oscillators," "73," August 1969.
4. "Transistor Oscillators," The Radio Amateur's Handbook, A.R.R.L. Staff, 1969, chapter 4, p. 87
5. Rufus P. Turner, "How to Use Grid-Dip Oscillators," John F. Rider, Inc., New York, N.Y., 1960.

COUNTER USED FOR FREQUENCY MEASUREMENT

(Continued from Page 13)

Unit to allow counting for 1 second and 10 second intervals. The longer time interval is necessary to count the last column (cycles) when the frequency is 1 MHz. (as the input is divided by ten).

WHAT DOES IT DO?

Well, what does the thing do? It counts the 10 cycles per second output of my unijunction sweep generator. It counts the output from a small transistor oscillator using a 1 MHz. crystal. While counting for 1 second at this frequency the overflow indicator comes on but it is easy to see how many times the 10^4 decade has counted. If you count for 1/10 second you lose a decade, of course, but the blinking display allows rapid calibration of an audio oscillator—you'll never go back to Lissajous figures. The last figure displayed will, of course, vary so that a frequency of 1 MHz. may be displayed as (1)000 00(0) or (1) 00 001(0)—this is the nature of the beast.

COMMENTS

Some comments are necessary. The input as shown is not protected (I don't seem to use valves any more) and resetting 9×10^4 activates the overflow indicator. The amplifier in the Control Unit will act as a receiver if you put an aerial onto the input—put your finger on it and measure your frequency! It will also count 100/second if you feed it with insufficiently filtered d.c. It may be necessary, on occasion, to pay some attention to the input impedance of this amplifier.

It may be appropriate to point out that this was a project for the long winter evenings. Indoor summer temperatures in Sydney occasionally rise to a level at which transistor devices misbehave if there is no temperature compensation.

The three sub-units are mounted in a cabinet as illustrated in the photograph. The second 12 volt regulated supply is identical to the first and is included in the Control Unit.

Thanks are due to Mr. D. Cato for panel decoration of the Counter Unit and Dr. Bruce McMillan for the photographs.

REFERENCES

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POWER IN A.C. CIRCUITS

LECTURE No. 8A

C. A. CULLINAN,* VK3AXU

Lectures 5, 6, 7 and 8 have dealt with some aspects of alternating current and this lecture proposes to carry these further and deal with the power in a.c. circuits.

In Lecture No. 6 we described briefly a perfect a.c. generator and stated that if a purely resistive load was connected to it, then all the power flowing in the resistor would be used. This is because the resistor has unity power factor and no power is returned from the resistor to the generator as all the power in the resistor is converted into heat.

In an alternating current circuit containing only pure resistance the current and voltage are in phase. That is, the voltage and current pass through corresponding parts of their cycle at the same instant.

For instance, if the generator voltage equation is

$$e = E_M \sin \omega t$$
$$= 311 \sin 377\, t$$

then the current through the circuit is

$$i = I_M \sin (\omega t + \theta)$$
$$= I_M \sin (\omega t + 0°)$$
$$= 5.66 \sin 377\, t \text{ a.}$$

where $_M$ means maximum.

The voltage and current may differ widely in their amplitudes, the frequency factors are equal and the phase angle between current and voltage is 0°.

It should be obvious that Ohms Law says nothing about maximum, average or effective values of current or voltage. Any of these values may be used, i.e. maximum current may be used to find maximum voltage, but maximum current is not used to find, say, the effective voltage unless the proper conversion constant is introduced into the equation.

It is the usual practice to consider all a.c. voltages and currents as "effective" values unless stated otherwise. The term r.m.s is frequently used in place of "effective".

In a direct current circuit the power is equal to the product of the voltage and current, that is

Power = Volts × Amperes

This is true, also, for alternating currents for **instantaneous values** of voltage and current, i.e. the **instantaneous power** is

$$p = e\, i.$$

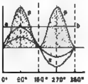

Fig. 1

Guidance notes:
e is the voltage curve
i is the current curve
p is the power curve.

* 6 Adrian Street, Colac, Vic., 3250.

● Continuing the series of lectures by C. A. Cullinan, VK3AXU, at Broadcast Station 3CS for students studying for a P.M.G. Radio Operator's Certificate.

When a sine wave of voltage is impressed across a resistance, the relationships of voltage (e), current (i) and power (p) are shown in Fig. 1. For clarity the amplitudes of the voltage and current are different.

The voltage which exists across the resistance is in phase with the current flowing in the resistance. An examination of Fig. 1 shows that at the start of the cycle, both voltage and current commence at 0° and each reaches its maximum at 90°. Both fall to zero at 180°, then rise to maximum in the opposite direction at 270°, then again fall to zero at 360°.

In this case there is no phase difference between the voltage and current and this is the condition for unity power factor, i.e. p.f. = 1.0.

The power delivered to the resistance at any instant is represented by the height of the power curve. This is the product of the **instantaneous** values of voltage and current at that instant.

The shaded areas under the power curve (p) represents the total power delivered to the circuit during one complete cycle of voltage.

It should be noted that the power curve is of sine wave form, having a frequency twice that of the voltage.

Also, it should be noticed that the power curve (p) lies entirely above the X axis, as there are no negative values of power in the proposition under discussion although both the voltage and current are below the X axis for one-half of the cycle.

This may be explained in a simple manner. In Lecture No. 6 reference was made to toaster elements having very little reactance. Now if we connect a toaster, with this type of element, to the a.c. mains it transforms electrical energy into heat. On the positive half-cycle of the a.c. mains (above the X axis) the element gets hot. Now on the other half-cycle (below the X axis) it remains hot; it does not get cold during this half-cycle. For simplicity, we have treated the toaster element as a non-reactive resistor because the reactance is so low. The purist may shudder because there is a little reactance. The artificial aerial described in Lecture No. 6 has a measured resistance of 51 ohms and an inductive reactance of 20 ohms at 1 MHz., so its reactance at 50 Hz. is mighty small.

One other thing will be noticed from Fig. 1, and that is that when the voltage and current both have the same sign (either positive or negative), then the power is positive (above the X axis).

The maximum height of the power curve is the product of the maximum values of voltage and current, thus

$$P_{MAX} = E_{MAX} \times I_{MAX}$$

The **average** power delivered to a purely resistive load is shown by the line a–b in Fig. 1, which is half the maximum height of the power curve. From this we have

$$\text{Average Power} = P = \frac{P_{MAX}}{2}$$

$$\text{and } \frac{P_{MAX}}{2} = \frac{E_{MAX} \times I_{MAX}}{2}$$

$$\therefore P = \frac{E_{MAX}}{\sqrt{2}} \times \frac{I_{MAX}}{\sqrt{2}}$$

$$\therefore P = E \times I$$

Therefore the a.c. power consumed by a resistance load is equal to the product of the effective values of voltage and current, i.e. r.m.s. values.

As in direct current circuits, this power is measured in watts.

REACTIVE LOADS ONLY

Having dealt with power in an a.c. circuit containing only pure resistance, we now turn our attention to an a.c. circuit containing only pure reactance as this will be a logical step towards an a.c. circuit containing both resistance and reactance.

Fig. 2 shows the voltage (e), current (i) and power (p) relationships when a sine wave of voltage is impressed across an inductance which has no resistance. This delightful state of affairs cannot exist in practice, but it is desirable to assume a pure inductance for this part of the lecture.

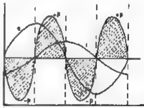

Fig 2

Guidance notes.
e is voltage,
i is current,
p is power curve,
Power above the axis is plus and below is minus
The shaded portion is power within the power curve.

It will be seen that the voltage has been drawn so as to start to rise in the positive direction, above the X axis, at 0° and that the current starts to rise positive 90° after the voltage started to rise. This means that the current is lagging behind the voltage by 90°, thus there is a phase displacement between the voltage and the current. Compare this with Fig 1 where there was no displacement.

Now let us examine Fig. 2 in detail. When current is increasing from zero to maximum positive, during the interval 90° to 180°, power is being taken from the source of electro-motive force (e.m.f.) and is being stored in the magnetic field around the inductance.

As the current through the inductance falls from its maximum positive value at 180° to zero at 270°, the magnetic field is collapsing, thus returning power to the source. This is shown by the shaded portion of the power curve p, below the X axis.

During the excursion of the current from 270° to 360°, although the current is now negative (below the X axis), the power curve is positive (above the X axis).

From 360° to 90° of the next cycle the current drops to zero at 90°, the magnetic field around the coil has been collapsing and power being negative is returned to the source.

Thus we have the situation that positive power is followed by negative power.

The positive power is taken from the power source and the negative power is returned to the source, therefore the circuit does not consume power although power alternately flows from and to the source.

When a source of alternating current is impressed across a pure capacitance power is taken from the source and stored in the capacitance whilst the voltage is rising from zero to maximum in the positive direction, 90° to 180°. As the voltage falls from maximum at 180° to zero at 270°, the capacitance discharges back into the source, but this is negative power. The voltage then becomes negative from 270° to 360° lying below the X axis but the power is again positive, being taken from the source.

At the beginning of the next cycle the voltage starts to fall from 0° to 90° and the power is returned to the source as it is negative power.

The capacitive circuit may be understood by referring to Fig. 2 and transposing e and i. In this case the current leads the voltage by 90°.

An examination of Figs. 1 and 2 show that when the voltage and current are both of the same sign the power is always positive irrespective of whether or not they are positive or negative (above or below the X axis). However, when they are unlike, then the power is negative.

Further examination of Figs. 1 and 2 shows that when the circuit is purely resistive, there is no negative power because the voltage and current, being in phase, have the same sign at all times.

However, when the circuit is purely reactive there is a phase displacement between the voltage and current, at times they are of the same sign and at other times they are of opposite signs, thus there is positive and negative power in the circuit.

In a purely reactive circuit no power is absorbed by the reactance, however power does flow to and from the source.

This is known as **reactive** or **apparent** or **wattless** power as it can be determined by voltmeter and ammeter readings and is given by $P = E \times I$ and is measured in **volt-amperes** (VA) or if large in **kilovolt-amperes** (KVA).

RESISTANCE AND INDUCTANCE IN SERIES

So far we have seen that when the load is purely resistive the voltage applied across the resistance and the current flowing through the resistance are in phase, whilst in a circuit where the load is purely reactive the voltage and current are 90° out of phase. The voltage will **lead** or the current **lag** the other when the circuit is inductive and the voltage will **lag** and the current **lead** the other when the circuit contains capacitance only.

However, circuits usually contain both resistance and reactance.

In Fig. 3 is shown a circuit containing resistance and inductance. $R = 6$ ohms and $X_L = 8$ ohms. These values have been chosen for ease in computations.

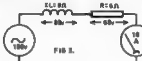

FIG 3.

Using the methods shown in Lecture No. 6, the following results will be obtained:

Current through circuit = 10 amp.
Voltage across resistance = 60v.
Voltage across inductance = 80v.
Phase angle θ between voltage and current = 53.1°

thus the voltage **leads** the current by 53.1°, or the current **lags** behind the voltage by 53.1°.

RESISTANCE AND CAPACITANCE IN SERIES

If a capacitance of 8 farads is substituted for the inductance of Fig. 3, calculations will show that the same answers will be obtained, however in this case the voltage will **lag** the current or the current **leads** the voltage by 53.1°.

RESISTANCE, INDUCTANCE AND CAPACITANCE IN SERIES

We have shown that inductive reactance causes the current to **lag behind** the voltage and that capacitive reactance causes the current to **lead** the voltage, hence these two reactions are opposite in effect. If the inductive reactance and the capacitive reactance have exactly the same value, then they cancel each other exactly, i.e. taking the two variations for Fig. 3, we have $X_L = 8$ ohms, $X_C = 8$ ohms, and if both are connected in series we have:

$$+ j8 - j8 = 0$$

so the net reactance is zero. This is the condition for series resonance.

At one time in Australia's history there were wide differences in the voltages and frequencies of a.c. power supplied to the public, but nation-wide voltages between 200 and 250 volts at a frequency of 50 cycles per second is becoming standard. Western Australia used 40 c.p.s. for many years.

For Fig. 4 a voltage of 220 has been selected. This figure shows a series circuit containing resistance, inductance and capacitance having different values to those given in the circuit problem of Lecture No. 6 so that the student may gain experience in working out this problem and checking the answers given here.

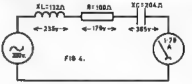

FIG 4.

$R = 100$ ohms
$X_L = 132$ ohms
$X_C = 204$ ohms
Impressed voltage = 200 volts
$\therefore$ voltage across resistor = 179 volts
voltage across inductance = 236v.
voltage across capacitance = 365v.
current flowing in circuit = 1.79a.

Power factor is 0.8 (to nearest decimal place; 0.812 to three places). The impedance is 123 ohms, and the phase angle is —35.8°, which means that the voltage lags the current by this phase displacement.

The nett reactance of the circuit is:

$$+ j132 \text{ ohms} - j204 \text{ ohms} = - j72 \text{ ohms.}$$

This shows that the nett reactance is capacitive and the circuit resolves itself into a resistance of 100 ohms and a capacitive reactance of 72 ohms in series.

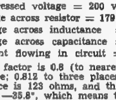

FIG 5.

Guidance notes
Drawn as closely as possible for voltage, current and power for circuit of Fig. 4,
e is voltage curve,
i is current curve,
plus p is positive power,
minus p is negative power.
In this case most of the power is taken by the circuit and only a small amount as shown as the minus p is returned to the source.

Fig. 5 represents the relationship between voltage, current and power for the circuit and values of Fig. 4, and an attempt has been made to draw Fig. 5 to scale.

e is the impressed voltage
i is current flowing in circuit
p is the positive power in circuit
—p is the negative power in circuit
θ is the phase angle.

As has been stated previously, the instantaneous power in the circuit is equal to the product of the impressed voltage and the current through the circuit.

It has been stated, also, that when the voltage and current have the same sign, irrespective of whether they are both positive (above) or negative (below the X axis) they act together and take power from the source. However, when their signs are different, again

irrespective of their positions in relation to the X axis, they are operating in opposite directions, the power is negative and is returned to the source.

The **apparent power**, $P_A = EI$, whilst the **true** power, $P = I^2R$ or

$$P = E_RI$$

where E_R is the voltage across the resistance in the circuit.

Apparent power is sometimes called total power, whilst true power is the power which produces work.

The **power factor** is the ratio of the true power to the apparent power.

$$\text{Power Factor (p.f.)} = \frac{P \text{ true}}{P \text{ apparent}}$$

$$= \frac{P}{P_A}$$

$$\therefore \text{p.f.} = I^2R \div EI$$

$$= IR \div E$$

then because $E = IZ$

$$\text{p.f.} = IR \div IZ$$

$$= R \div Z$$

Thus the power factor of a series circuit may be obtained by dividing the resistance of the circuit by its impedance.

The power factor may be expressed in terms of the angle of lead or lag.

$$R \div Z = \cos\theta$$

$$\therefore \text{power factor} = \cos\theta$$

and true power, $P = P_A \cos\theta$

or true power, $P = EI \cos\theta$

From the data given earlier,

$$P = I^2R = 1.79^2 \times 100$$

$= 320$ watts (nearest whole number)

or $P = E_RI = 179 \times 1.79$

$= 320$ watts

or $P = EI \cos\theta =$

$220 \times 1.79 \times \cos 35.8^\circ =$

320 watts.

Power factor is usually expressed as a decimal and

$$\cos\theta = \cos 35.8^\circ = 0.812.$$

If expressed as a percentage

$$\text{p.f.} = 100 \cos 35.8^\circ = 81.2\%.$$

RATING OF A.C. GENERATORS

Manufacturers of alternating current generators rate their machines as being capable of delivering a certain number of kilovolt-amperes (KVA) and not as being capable of delivering so many kilowatts (KW).

This means that they guarantee that the generator if kept revolving at the correct speed will generate a certain voltage and that it will stand a certain current without overheating.

This is because they cannot guarantee it as being able to generate a specified or certain amount of power under all conditions of use because they do not know the nature of the load that the user will use.

Suppose an a.c. generator was guaranteed to deliver 10 KW at 200 volts and that it was connected by the user to a load having a power factor of 0.7.

Then it would have to supply an apparent power of $10{,}000 \div 0.7 =$ 14,285.7 watts

or 14,286 watts to nearest whole figure. So that the true power should be equal to the apparent power,

$$14{,}286 \times \cos\theta \; (0.7).$$

This means that the generator would have to supply a current of $14{,}286 \div 200 = 71$ amps. (to nearest whole number) instead of $10{,}000 \div 200 = 50$ amps.

The additional current that the machine has to produce would cause additional heating and could damage the machine.

From this it can be seen that the rating of a.c. generators is dependent on the amount of heat that the windings can stand.

Thus a.c. generators are rated in kilovolt-amperes which is a direct measure of the heating factors in the windings and a true measure of the capacity of the machine to do work.

Large transformers are rated in the same manner and for the same reasons. Sometimes small transformers are rated in volt-amperes (VA). Some of the transformers detailed in Radio Parts Pty. Ltd. catalogue have their power ratings shown in VA because the manufacturers do not know the types of loads that users will employ, as it is one thing for a manufacturer to specify that a transformer is to be used for a particular purpose, then to ensure that the purchaser will use it for that purpose.

RECAPITULATION

In this lecture we have assumed that the resistances were pure resistances, that is non-reactive. It is fairly easy to make resistances having little if any inductance, and with very little distributed capacitance. However, it is virtually impossible to make an inductance which does not have some resistance and capacitance, also it is impossible to make a capacitor which does not have some resistance, although it may be very small, also the capacitor may have a small amount of inductance, but it was desirable to make the assumptions that were made.

In an a.c. circuit containing only resistance the power factor is unity and in a circuit containing only reactance the power factor is zero.

In a well designed reactance the power factor will approach zero and the current will either lead or lag the voltage by nearly 90°. If the reactance is not well designed, then the power factor will lie between zero and 1.0 and the angle of lead or lag may be far less than 90° and losses in the reactance will be large.

Finally, in Lecture No. 5 there was shown the effective value of an alternating current. The effective value of an alternating current is the equivalent value of a d.c. current which would give the same power dissipation in a resistance R as an alternating current amplitude I. effective.

The power dissipation in the d.c. case is:

$$P = I^2R,$$

$$P = VI, \text{ or } V^2 \div R$$

where P is the power, I is the d.c. current, and V is the d.c. voltage.

The power dissipation in an a.c. case of pure resistance is:

$$P = I^2R,$$

$$P = VI, \text{ or } V^2 \div R$$

where P is the power, I is the effective a.c. current, and V is the effective a.c. voltage. The term root-mean-square (r.m.s.) means the same as effective. The term r.m.s. is derived from the fact that it is the square root of the average (or mean) value of the squares of all the different values the current can take during one complete cycle.

r.m.s. effective and virtual all mean the same thing when dealing with a.c. circuits.

Overseas Magazine Review

Compiled by Syd Clark, VK3ASC
and R L. Gunther, VK7RG

"THE AUSTRALIAN E.E.B.

October 1970—

Good SCR CD Ignition System, VK1ZVG. A work mate says his "Jag," goes better with one. My Holden is fast enough without! Your choice, friend.

Feedback in Complementary Symmetry Amplifiers, VK7ZDF Self explanatory.

Third Party Traffic, VK7RG. Seems to me now, and has for years, that the government operated commercial communications system would not be damaged by granting Amateurs the right to communicate for others. Much good could come from such a right because more Amateurs would become trained communicators.

Review copy by courtesy of E.E.B., P.O. Box 177, Sandy Bay, Tas., 7005. One year $A1.05; three years $A2.95, to R. A. Walton, 115 Wilmot St., Huonville, Tas., 7109.

"HAM RADIO MAGAZINE"

September 1970—

Editorial: Jim Fisk continues his series of non-political interesting discussions of new technical developments. This time on microwave acoustics, but "micro" sound waves on piezo-electric resonators. The result is an improved filter, delay line, resonator, or amplifier in the region below 50 MHz.

An Integrated Circuit Balanced Modulator.—The Motorola MC1596G can be used as balanced modulator, a.m. modulator, a.m. detector, product detector, mixer, or frequency doubler Consists of a dual differential amplifier driven by a standard differential amplifier; a couple of transistors worth of chip provides constant current drive. (Availability in Australia is probably questionable, at least in 1971, but the whole device could be made for about $1 from computer transistors, using the diagram furnished in this article, it could be well worth doing. There is one likely misprint: For the product detector shown, he claims a dynamic range of 90 dB., the actual figure is more like 30 dB.)

The Mainline ST-5 R.T.T.Y. Demodulator.—Uses two linear ICs to reduce complexity and cost by an order of magnitude, compared to previous designs.

An F.M. Receiver for Two Metres.—The author discovered that by doing a good job at the workbench it was actually possible to get better results than from a commercial unit. MPF102s in the front end, and double conversion, with ICs as i.f., discriminator and a.m. power, A 10.7 MHz. bandpass i.f. and 455 KHz. second i f gives adequate gain

A Multimode Transmitter for Six and Two Metres.—Addition of 829B valve linear amplifiers to previous designs provide higher power output on a m or s.s.b , 2 or 6 metres.

R.F Impedance Bridge.—Unlike the Antenna Noise Bridge (which has its own signal source) this is an ordinary r.f. bridge which takes its signal from the transmitter Inductive component is analysed by looking at capacitative component, and transliterating by the use of the Smith Chart, which is described briefly; for more comprehensive treatment of the Smith Chart, see the November 1970 issue.

Neutralising Small Signal Amplifiers.—Valves and FETs which need neutralisation as converters or pre-amplifiers can display annoying instabilities. This author shows how to overcome them, thus giving the higher gain and lower noise provided by optimum neutralisation.

Electronic Counter Dials.—A readout of frequency for the v.f.o. of his receiver Instead of the now more conventional cycle-counting method, he employs a trick useful for restricted frequency ranges the v.f.o. is heterodyned with a crystal standard and the beat note is divided by a decade counter which reads out on simple gas-filled glow lamps.

Solid State Audio Oscillator-Modulator.—Another sine wave phase shift transistorised a.f. oscillator that works at 4.5v. and uses no lumped inductance

Reactance Nomograph.—Very useful, but only if you tear it out and paste on the wall so that it is readily available when needed.

Parasitic Oscillations in High Power Transistor R.F. Amplifiers.—Transistors present unique problems not enjoyed by valves in class C amplifier service and some of these are explored here. Must-reading for all semi-conductors-at-any-price enthusiasts.

Direct Conversion C.W. Transceiver Operation.—C.w. operation of transceivers is much facilitated by slight frequency offset between the stations involved. Rather than being the disadvantage popularly believed, it facilitates operation and improves c.w. selectivity. It is best achieved by standardisation of peaked resonant filters in all relevant c.w. transceivers.

The Repair Bench.—Finding faults in r.f. and i.f. amplifiers, semicons. and valves. Very useful, but of considerable importance in catching possible wild geese is the author's caution: "A trouble in the stage may be caused somewhere else"! The a.g.c. system is a favourite culprit, including the S meter circuit.

October 1970—

The S.W.R. Meter.—You can trust the reading of this s.w.r meter, which you cannot do with "s.w.r. bridges, antennascopes, or other gadgets that base their calibration accuracy on the characteristics of their semiconductor diodes." The technique described is borrowed from standard microwave procedures.

The Sideband (or C.W.) Minituner.—A pocket sized direct conversion receiver for 80 and 40 metres, using FET product detector in the common base mode. Audio is fed through a low-pass RC filter, FET-amplified, and then into a commercial a.f power module.

Voltage-Probe Receiving Antenna.—"A new two-inch-high electronic device that out-performs a 3 ft. whip below 40 MHz." And furthermore, its gain is flat from 30 KHz. to over 50 MHz.

Designing with IC Voltage Regulators.—Inherent device constraints are analysed and design examples are given to obtain optimum regulator performance.

Lunar-Path Nomograph.—An aid for determining signal attenuation due to variance in earth-moon distance.

Converted BC1206 for 7 MHz.—Conversion to FETs and thus retaining the advantage of l.t. operation and the other obvious benefits as well. MOSFETs and JFETs are used at r.f. To obtain operation at h.f., semicon broadband converters are added.

Low Noise Converter for 432 MHz.—A circuit using inexpensive FETs that gives a good account of itself Easier and better than valves in this instance

Precise Frequency Tuning with S.S.B. Equipment.—Hints on pinpointing operating frequency in the s.s.b., c.w and r t.t.y. modes.

Ideas for an Electronics Workbench.—A well designed workbench is essential for experimenters.

Introduction to Thyristors.—How to use these silicon controlled rectifiers and triacs. Very good, and detailed.

Modular Two Metre Converter.—A modular approach to u h f front end designs, with special emphasis on constructional details. Use of glass-epoxy board with large areas of copper to reduce lead inductance.

Improving the Voice Commander F.M. Sets.—Rather obscure, from an Australian point of view.

"OHM"—The Oriental Ham Magazine

September 1970—

The Intruders, K6KA.—Discusses signals close to 14060 and 7130 and others which the author states should not be where they are.

Your S.W.R. Meter and You, VS6AD.—How to get the most out of this device which can give misleading results or at least results which are capable of misinterpretation.

Codes Explained, VS6DD.—The author explains the various systems which are commonly used on radio circuits.

Bridge Rectifiers, Andy Patrick.—Modern circuits for modern solid state units.

"RADIO ZS"

November 1970—

Using Old Motors, ZS1NU.—Sets out to tell you how an old washing machine motor can be used to rotate a beam. Have you ever thought of using a long belt or rope between the rollers of an old washing machine wringer?

A.M.-S.S.B. Reception, ZS1NU.—Circuit of a 12AU7 used as a product detector in the older type receiver.

Modifications to KW Viceroy Mk. I, S.S.B. Transmitter, ZS1NU.—Changing the 7 MHz. band from u.s.b. to l.s.b.

How To Use R.F. Power Transistors, by WA7KRE.—Reprinted from "Amateur Radio," May 1970.

"SPECTRUM"

September 1970—

This little magazine is a quarto-duplicated effort by the Auckland V.h.f. Group Inc. About half of its more than 30 pages per month is taken up with interesting Radio Amateur activities on v.h.f. all over New Zealand, and the rest with technical articles in the best experimenters' tradition As with al. magazines, some issues are better than others, but the overall standard is high, and the magazine is well worth the modest subscription price, $1 50. Their address is Spectrum, P O. Box 5268, Auckland, New Zealand

Contact Potentials.—Listing standard potentials of various metals, relative to calomel.

Ferrite Tube Chokes. Listing of impedances at various frequencies of 1 inch length of ferrite tube with one or with two turns of wire through it.

Corrosive Comment.—More about relative corroding abilities of various metals in contact with each other, In cathodic metals (e.g. brass, copper, nickel) are placed in contact with anodic ones (e.g. magnesium, zinc, iron, solder), the cathodic ones will corrode the anodic ones.

Tait 50.—A complete transmitter-receiver, valved, EL95/6973 in final.

A 2 Metre QQE06/40A Linear Amplifier.—Complete details. Copper-tubing tank, SE7030 h.t. transistor for screen stabilisation.

Fickle FETs.—Methods for avoiding static (and other) overload catastrophes when using MOSFETs. Best of all, he suggests using protected FETs, like the 3N187 up to 300 MHz. or 3N200 up to 500 MHz. U.S. prices are not bad.

½ Watt Audio System for a Receiver or QRP Modulator.—Part 3 in a series of IC projects. The use of the TAA300.

V H.F. Aerials for the Amateur.—Polar plots from tests run on the five aerials tested and described in the August 1970 issue of "Spectrum"

The Log-Periodic Yagi.—Full constructional details. Very nice.

A Beginner's Project.—Part I. Two JFETs in a cascode r.f. stage.

October 1970—

(Noted in an adv.—There seems to be nothing wrong with the supply situation in N.Z. 1300 MHz. 2SC387 transistors for 55c each, $5 the dozen)

A Handi-Checker.—A combination field strength meter, marker oscillator and crystal activity checker

Another Folder.—Design for a metal bender.

Modifications to Tait 50 for use on 146 MHz. Also modifications to Tait 53 and Tait 53F. Full details.

SWR 1.1 Fact or Fiction?—A good article, full of commonsense.

Note on Dual Gate FET Converter.—A number of magazines have unthinkingly propagated the error set by Sept. 1967 "QST": The gate of the second FET should not be grounded directly And "parallel cascode" is preferable to "series cascode" to allow the highest gain and lowest cross modulation achievable from at least 12-15v. of d.c. supply

A Protected 12V. Power Supply (Part 4 in a series of IC projects).—

The Ovatimer.—Describing the availability of a commercial unit to time the length of "overs".

C.W Language.—How to abbreviate and retain intelligibility—it says here. A complete vocabulary decoder is furnished.

More C.W. Sending Aids.—More of same, more sophisticated version.

"V.H.F. COMMUNICATIONS"

November 1970—

A S.S.B. Transceiver with Silicon Transistor Complement, Part 4.—Power supply and a.f. amplifier By DL6HA.

Printed Circuit Board for the Two Crystal Oscillators of the 145 MHz. MOSFET Converter used in the DL6HA s.s.b. transceiver, by DL-3YK

Synthesis V F O. for 24 MHz., DL3WR.

Steep Skirted Active Audio Filters, DJ4BG. The output begins to fall at 3 KHz. and is down 10 dB. at about 4.5 KHz. and then falls at the rate of about 25 dB./octave. Different circuits and characteristics are shown.

Speech Processing, DJ4BG—Various types are discussed

Stripline Transverter for 70 Cm., DC6HY.—Solid state except for an EC8020 valve.

A Simple V.H.F.-U.H.F. Calibration Spectrum Generator, DC6HY.—Signals are audible up to about 500 MHz. 5 dB. above noise in a receiver with a noise figure of 7 dB. With a 1 MHz. crystal signals are approximately 30 dB. stronger

Neutralisation of the DL3XW/DJ4BG Calibration Spectrum Generator, DJ4BG.

Two Circuits for Automatic Band Scanning, DL9FX.—The lazy man's way of watching the band.

VHF

Sub-Editor: ERIC JAMIESON, VK5LP
Forreston, South Australia, 5233.

Closing date for copy 30th of month.
All Times in E.S.T.

AMATEUR BAND BEACONS

VK0	53.544	VK0GR Antarctica.
VK3	144.700	VK3VE Kilsyth, 20m. E. of Melb.
VK4	144.390	VK4VV 107m. W. of Brisbane.
VK5	53.000	VK5VF Mt. Lofty
	144.800	VK5VF Mt. Lofty
VK6	52.006	VK6VF Tuart Hill.
	52.900	VK6TS Carnarvon.
	144.500	VK6VE Mt. Barker
	145.000	VK6VF Tuart Hill.
	435.000	VK6VF (on by arrangement)
VK7	144.900	VK7VF Devonport.
VK9	144.600	VK9XI Christmas Island.
ZL3	145.000	ZL3VHF Christchurch.
JA	51.995	JA1IGY Japan.
W	50.091	WB6KAP U.S.A.
HL	50.100	HL9WI South Korea.

A further addition to the beacon list can be made again this month with Roger VK0GR, stationed at Casey base, operating a continuous beacon on 53.544 MHz., sending the call sign at 2 words per minute for 55 seconds, followed by a 5-second break. Beam heading from Melbourne about 60 degrees West. (About S.W. for VK5.) As well as watching 6 metres, Roger operates between 14130 and 14260 KHz. s.s.b. most evenings.

While dealing with the frozen south, mention should be made of two other v.h.f. operators going down that way. Phil ex-VK3FF, now VK0PF, expects to be operational on 6 and 2 metres from Casey, and will be looking to establish some v.h.f. contacts with Australia via auroral scatter. Please send me some news Phil when you get going! Also down there soon will be Keith ex-VK5ZKG, now VK0MX, who will be firstly operational on 14 MHz. s.s.b., later followed by 53.352 MHz. using 4/250A in the final. [Also licensed for operation at Mawson is VK0ZPO.—Ed.] So collectively, with a bit of luck, VK0 may come on to the v.h.f. scene this year, particularly next DX season if the boys down there can keep going that long. Their exploits should make very interesting reading so I will try and get some news from them.

Getting back to beacons for a moment, I am always doing my best to ensure the listings given at the top of this page are accurate. If the locations have been altered, or a variation in frequency has been made, please tell me. There is nothing worse than something as important as a beacon to be off the air, changed frequency or for some other cause not to be as listed. For newcomers to the v.h.f. bands, the television stations scattered around our Continent can be useful indicators of band openings. They have an advantage for those with not the most stable of receivers that monitoring for long periods can be done by the average receiver and knowing that should the strength of the stations build up sufficiently they will be heard because of the large area of band space they cover. The following will probably be found to be the most useful:

Channel 0—51 740 MHz.	Western N.S.W.
	51 750 MHz.	Brisbane.
	51 760 MHz.	Melbourne.

Further afield but often heard is WNTV on 50.750 MHz. from Wellington, New Zealand. Of limited interest will be Channel 5A from Wollongong, N.S.W., on 142.750 MHz. Other more interesting stations to keep an eye on during the height of DX seasons are those operating on Channel 3 about 92 MHz. These can be pointers towards suitable conditions for 144 MHz. openings. For those living in the southern States the chief stations to watch on Ch. 3 are located mainly in Queensland, in the Darling Downs area, Rockhampton and Townsville. All three were observed at my location many times this year, with excellent signals, sometimes all three at once, at others, one fading out to allow the other in, etc. All three call signs were copied easily from the test patterns in the mornings.

Just a final word while on t.v. stations. It is noted with interest in the January 1971 "E.A." listing of Australian television stations that the use of Channel 0 Translator Stations is becoming quite wide spread, particularly in N.S.W., so I guess there will be a few grumbles from those areas before long! Just take a peer at pages 104 and 105 to see how wide-spread television has extended now!

REPEATERS

The installation of repeater stations for the Amateur Service is now quite widespread throughout Australia. Probably the latest to go into operation is that in VK5, a very nicely constructed solid state device running 15 watts output on Channel 4. A full description of its working capabilities and possibilities was outlined to the January meeting of the W.I.A. VK5 Division by Garry VK5ZK and Ian VK-5ZIP and the completed equipment was on display. Much good thought and excellent engineering practice went into its design and manufacture and the finished article is a credit to those concerned. Rick VK5ZFQ was observed on Sunday, 31st Jan., giving the repeater a good workout from its home at Crafers near Mt. Lofty and good signals were noted over the rather rugged path to my QTH.

The following repeaters are either operational or in a testing condition: Ch. 1, Gold Coast, Qld., Ch. A, Sydney, Ch. 1 in, Ch. 4 out, Central N.S.W. (may soon operate on Ch. 1 out); and the following on Ch. 4: Bendigo, Geelong, Latrobe Valley, Mildura, North Tasmania and Adelaide. A channel has been allocated to the Albury area—possibly Ch. 1. Thanks to the Geelong Amateur Radio and T.v. Group Newsletter for this information.

DX NEWS

I think it would be fair to say most operators have had quite a good DX season this year. Certainly there seems to have been a greater consistency of good openings to most call areas on 6 metres, some very good high scores in the Ross Hull Contest have been noted. Signals from ZL have shown an increase over last year and with the appearance of C21AA (Bob) from Nauru up near the equator working stations in VK2 and VK4, considerable more interest than usual was shown on 6 metres. C21AA also reported hearing the "Station with the big sound" Bob VK3ZDX, on one occasion, but Bob was too busy talking to someone else to worry about stations on the equator! Ken VK3ZNJ receives some distinction by working ZL3AAN and ZL4PG on 4th January from Melbourne at S9, thus giving his "Worked all ZL Call Areas" for 6 metres.

Bob VK3AOT, in a lengthy screed for which I thank you, comments on the number of short skip openings from VK3 to VK5 and VK7, with one fantastic opening to VK7 on 4th January with all signals many dBs over S9. Bob remarked also on the large number of times Kerry VK5SU at Ceduna in Western South Australia was received at good strength. He also worked VK6ZAG at Carnarvon on 10th, which is a very long path.

Further notes from Bob's pen shows that he was successful in working Lance VK4ZAZ with signals up to S5 on 2 metres on 12th Jan. The opening lasted only from 1320 to 1325. Lance was a good signal on 6 metres but not over strong, at the same time. VK2s at that time were hearing both VK3s and VK4s, indicating an extensive patch of strong Es. Lance also heard VK3AKR after the contact with Bob had concluded but the band closed before a contact could be made. Alan VK2ZEO, at Deniliquin, was also heard on 2 metres the same day.

It looks as though the efforts of Eddie VK1VP were not in vain when he went portable on Mt. Gingera and worked Ron VK3AKC in Geelong on 2 metres, and Ian VK3ZDW (Mt. Buller) on 432 MHz., a distance of about 180 miles. Ian also worked VK1CG on the same occasion on 432.

Bob VK3AOT concludes his letter by asking the question whether anyone in VK8, particularly in the Alice Springs area, where there is now quite a group of Amateurs, are interested in building 2 metre equipment with a view to attempting contacts with the southern or eastern States? It's a little over 800 miles from Adelaide, and probably nearer 1200 to Melbourne, but no doubt it could be done some time if there are any interested parties. Bob has recently joined that rather select few who now only require a VK8 for W.A.S. on 2 metres, so one can understand his interest. (I hope to take 6 and 2 metre gear to Alice Springs during the winter months—will this help?—VK5LP.)

Another correspondent to write to me this month has been John VK2BHO, at Warilla, 60 miles south of Sydney. John is somewhat restricted in his 6 metre operating as he is at present using a modified Pye Mk. 3, crystal controlled, with the receiver tunable over a limited range of 51.9 to 52.4 MHz., with a ground plane antenna up 25 feet. However, undaunted, he heard C21AA on 20th December, heard plenty of ZLs, and worked ZL3RZ and ZL2AAN, apart from getting amongst the Australian DX. Here is an example where a person with limited equipment has set about making it tunable and thereby extending the range of his contacts. However, limited transmitter power makes itself known when so many stations can be heard but not worked. Good luck John.

MOONBOUNCE NEWS FROM VK3ATN AND ELSEWHERE

Ray VK3ATN hopes to work G3LTF on moonbounce during February, and to this end he has work under way for a new antenna system. He is running 100 watts c.w. on 1296 MHz. using a pair of 3CX100-A5s water cooled—it is possible to get 400 watts output from these tubes. Here are a few details of Ray's dish antenna.

Foundations are 18 feet deep and consist of four holes bulled out to 10-ft. diameter. The tower is 24 feet high. The existing 30-ft. dish gives marginal results, so a 36-38 ft. dish is being installed. Having twice the surface area, an improvement of 3 dB. gain on receive and transmit is expected. (For Sale: One 30-ft. dish—contact Ray VK3ATN!)

Under construction sixty feet south of the main dish is a 25-ft. tower having two-ft. square foundations ten feet deep. A tractor rear axle is used for a polar mount, and a motor drives in opposition to the earth's rotation with a 2,075,000 to 1 reduction from 1400 r.p.m.

The 2 metre array consists of Swan-type yagis, each having 14.5 dB. gain over a dipole, and cross polarised. The total antenna has 32 x 16 ft. long crossed yagis twelve feet apart. The feed impedance is 300 ohms in the middle and the gain in excess of 30 dB.

These facilities are available to any group provided that they bring their own equipment and help Ray with some of the work. Facilities are available for 144, 432 and 1296 MHz. moonbounce. Ray may try meteor-scatter to VK6 shortly.

For moonbounce work, the following sked times have been arranged:

Saturdays and Sundays—W2RRP, 14200 at [illegible].
Sundays—G3LTF, 14120 at 0800 GMT.
Any day (tentative)—K6MYC, 14290 at 0800 GMT; KP4DJN, on 21418; and K6IJN (no details).

KP4DJN has a 100-ft. dish steered by movements of the feed-line, and may soon be constructing a 300-ft. dish. **ZL1MO** has worked SM7BAE twice on c.w. on 2 metres on Nov. 28-30. **ZL1AZR** is out of the moonbounce business for awhile due to work commitments on space tracking near Auckland. (Reprinted from W.A. V.h.f. Group News Bulletin, Dec. 1970.)

In a future issue I hope to have a paragraph with some information about a "dyed-in-the-wool" c.w. operator of many years standing who finally saw the light of day and tried v.h.f., and phone at that too! Results: very good. There's a moral to the story, but let's wait for the paragraph.

That's all for this month. Still trying to get someone into "Meet the Other Man" from VK6. Hope all of you anxious to get into print will bear with me a little longer, it takes time to get right around. If any of you think you have a rather outstanding record of performance at v.h.f., no reason why you should not write to me and ask for the detailed form sent to all those invited, if it's okay when returned, then it is just a matter of time before you and your station details appear in these notes. By now, everyone should have a fair idea of what is needed anyway.

Closing with the thought for the month: "The only suitable gift for the man who has everything is your deepest sympathy." And did you know a Volkswagen has been referred to as a "transistorised Rolls Royce". 73, Eric VK5LP, The Voice in the Hills.

MEET THE OTHER MAN

Meet George Francis, VK3ASV/T, ex-VK3ZCG/T, of Morwell, 90 miles east of Melbourne, whose interest in radio started while at Wonthaggi Technical School and becoming an active S.w.l. During his apprenticeship as an electrician he became interested in small ship radio servicing, thus gaining valuable m.f./h.f. experience under a special experimental call sign VJ3B, then in 1954 he turned his interests to v.h.f., building up his own v.h.f. base-mobile network on 163.230 MHz. (VH3EN) which he put in service when he moved to Latrobe Valley at East Newborough, where his interests blossomed into Amateur Radio in 1955, with the call sign of VK3ZCG, a well known call sign for the next 14 years. His first v.h.f. operation was 144 MHz. a.m. and a 3 element yagi, followed by 288 MHz. in March 1956. His first 6 metre QSO was in July 1957 on the new 56 MHz. band, and later on the 50 MHz. band when it changed in November 1957. During January 1958 George experienced his first 50 MHz. Es DX, following later that year on 11th October working his

(Continued on Page 21)

DX

Sub-Editor: DON GRANTLEY
P.O. Box 222, Penrith, N.S.W., 2750
(All times in GMT)

It would appear that most of the overseas news sheets and such like have been delayed by industrial trouble, and my sources of information for this month's issue are almost non-existent. Those which I have are not noted for their reliability, so we shall have to make do with the little which we have.

From Ray Kearney comes a note that Col VK2BCC will be operating from Mawson using an HT32B, Drake 2B rx, and inverted vee antenna. Call sign will be VK0CC, commencement of operation was timed for the end of January, and QSLs for the operation go to Ray, who is VK2BRK.

Two of our regular contributors are missing from the line-up this month. Firstly Jack VK3AXQ has moved down to the city and at time of writing was QRT. S.w.l. Steve Ruediger, our reliable contributor from VK5, has gone out of circulation for some time due to work commitments.

VU5KV and XYL were due to operate from the Lacadives during December, however if you missed them, VU2CK, VU2RK and VU2KM were scheduled for a trip there in mid-February. Later on in the year, date unknown, VU2TP will head in the same direction.

Scotts QSL manager of the month for January is W3HNK. He does the chores for JA-6BEE, JA1IVV, YV5CEY, 4X4RD, 4X4UH, PZ1CF, EP2KB, EP2DX, 5A3TX, 5A5TR, PA-0COE, PA0HVM, UM8FM, UA3FF, LX1BW, GW3DZJ, SM0BUT, ZS3R, ZS3CJ, VK9BS, CR6LF, CR6KT, ZE4JS, 3Z9PT, SP9DT, KV-4EY, VP2VY, EL2BI, CN8BG, KR6HR, CT1MZ, CT1UA, CT1UE, CT1UD, CT1TZ, OX5AP, OY9LV, XP1AA. The December winner was very popular Mary Ann Crider, WA3HUP.

Long Is. DX Association would appreciate any information on an intruder operating every day on 21030 plus or minus a few KHz., and signing VVVV CQ de LVO. Info to David Ferrier, W2GHZ, 43 Cameron Drive, Huntington, N.Y., 11743, U.S.A.

News from the SV0 call areas is that the U.S. ban on SV0 Crete, and SV0 Greece, has been lifted. However, operation to Crete is restricted to contests when the 5B4 prefix will be used. SV0WX and SV0WOO are active from Greece with W3MNE being the latter's QSL manager, whilst SZ0DB is the special call commemorating the 150th anniversary of the Greek Revolution.

UF0OL claims to be in Nova Zimla Is. wherever that may be, however it seems that the U FOOL part of it may be in order, and certain of the U.S. gang place the station in Michigan, and the activity has been called to the attention of the F.C.C.

Late news from East Pakistan is that ON5DO/AP2 has apparently departed from the area and is being replaced by ON5CL, due to take over on Jan. 20. There could be a list going for this one on 14235 at 1215z.

Operation from Barbados by 8P6DQ from Jan. 21 to Feb. 2 was planned as a five-band operation by W2GQN and XYL WA2GSV. They were hoping for the additional call 8P6DX.

5U7 activity from Niger Republic is quite prolific, with 5U7AR, Box 44, Niamey, and 5U7AW, QSL to VE2DCY, being the main operators.

From Monaco, Jean 3A2EE, whose manager is F9RM, is very active and does a lot of cross Atlantic working on 80 metres. There is no trace of 3A2BNB calling himself Frank, and working into JA on 3rd Jan. on 20 c.w., in the news sheets. I heard him here at 1100z or thereabouts with a 599 signal operating at about 18 w.p.m., and at that speed I couldn't have made a mistake in the call. Hi. Has anybody any knowledge of him?

ZD8, Ascension Is., will be the location of W4SFA due to operate as ZD8OE after mid January. Other station active is ZD8CS who QSLs via K1BTD.

The elusive SUs have been about over the last few months, SU1IM using c.w. more often than not, and Moty SU1MA doing most of it. The latter is at Box 840, Cairo, Egypt, and uses Swan equipment with a dipole.

Awards from the "CQ" Magazine are now being checked by Kings County Radio Club, and applicants should send their QSLs, etc., to 1250 Ocean Ave., Brooklyn, New York, 11230, U.S.A.

The following stations can be QSLed via the ISWL, and contacts with them will count towards the Monitor Award, details of which were published in full last year: G3WQH, WB6MUU, 9Y4DS, SM2ERK, G8DZH, SK4DI, SM4DHF and LX1BW WA3MCP, W6JZU, HK0BKX, G3TUF, DL4UU, DL5BA were earlier additions which had not been listed here. The QSL bureau for the ISWL is our old friend Eric Chilvers, 1 Grove Rd., Lydney Glos, GL15 5JE, England.

The FO0 prefixes which have been used in the latter months are special prefixes for reciprocal licenses issued to non-resident operators in the FO8 call area. FO0TB and FO0TC were two of them, QSL to W6OFF and W9CTY.

Our much respected friend, Jock ZL2GX, noting my remarks in an earlier column re the murderous costs of IRCs in this country, has dropped me a line to let the chaps know that he will accept 25 cent mint Australian stamps in lieu of the IRCs for any of the N.Z. awards. This in anybody's language is a great help.

The N.Z.A.R.T. are to be congratulated on their awards programme, as is Jock as their Award Manager. It is unfortunate in a way that many of the great operators (and ZL2GX is in this category, being the first DXCC 300 in the world) are so taken up with administrative duties that they have not the time to get on the air as much as they would like and as much as we would like to have them. On the other hand, these chaps do a wonderful job as Award Managers, QSL Managers and what have you, that we must not complain.

QSL MANAGERS

AC3PT to W2MMC	ZD8H to K0ETY
C31DE to EI1AU	ZD8JK to WA3FNK
C31DG to G3CDK	ZF1ML to K9QFZ
C31DJ to WB6CAB	ZF1RL to K9QFZ
LX2CQ to DK1YK	5W1AJ to K56DH
TJ1AX to LA6XJ	9Y4VE to VE3GCO
TY7ATF to K3RLY	VP8LK to G3NOM.

SOME QTHs

CT3AN—C.P. 38, Funchal, Madeira Islands.
EA9EJ—Justo Benedicto P., Calle Madrid 1, Aaiun, Spanish Sahara.
FR7AB—B.P. 798, St. Denis, Reunion Is., Indian Ocean.
FR7AG—B.P. 819, St. Denis, Reunion Is., Indian Ocean.
IT1GAI—C.P. 13, Noto, Sicilia, Italy
JY2—Box 2101, Amman, Jordan.
SV0WY—T. Apostolos, 2140-15 Comm. Det., A.P.O. New York, 09223, U.S.A.
TG9ER—Apto 288, Guatemala City, Guatemala.
VE3GCO—Garry Hammond, RR4 Main St., Atwood, Ontario, Canada.
3Z0PZJ—Box 108, Koszalin, Poland.
5Z4DW—Box 14372, Nairobi, Kenya.
7Q7BC—Box 41, Zomba, Malawi.

The above list of managers and addresses refer mainly to stations which were active towards the latter part of 1970. It would be a hopeless, and unnecessary task, to try and print all the new DX QSL information which comes to hand, however if anybody is looking for a particular QSL address which has not appeared in print, I have the last twelve months issues of both Geoff Watts News Sheet and the popular Long Is. DX Bulletin here, and will be only too pleased to look up any back information, provided a stamped envelope is enclosed.

I would appreciate any local news which can be passed along, with the overseas situation as it is we never know from one month to another if the news sheets are going to arrive, and if they do, just how much will be missing from them. So the more we can have from here, the better.

That winds it up for this month. Let's hope the situation is better for the news issue. 73 de Don L2022.

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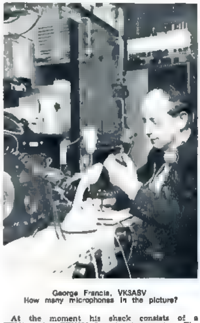
VHF NOTES

(Continued from Page 20)

first JAs using F2. Since then he has worked all VK, ZL and JA districts.

Some of George's 144 MHz. firsts using ground wave DX were 25/2/58 VK7LZ, 233 miles, 27/4/59, VK5BC, 410 miles, 27/2/66, VK-5ZDR, 480 miles, 16/11/66, VK2ZEO, 191 miles; also worked Hobart while out portable during a Field Day and heard the VK6 beacon. Es 144 MHz. DX: VK4HD, 905 miles. 288 MHz.: 19/7/59. VK3ALZ, 80 miles, 7/1/60, VK7LZ, 233 miles (this being a record for 15 minutes until David VK3ZAT, now VK3AU, worked him, extending the record distance by another 10 miles!), and 23/1/61, VK5AW, 256 miles. George has won several certificates: Winner of 4th VK3 V.h.f. Field Day 1956, Winner Phone and VK3 National Field Day 1958; winner W.I.A. V.h.f.-100 for 144 MHz. and above, dated 21/9/61, and winner N.Z.A.R.T. W.A.D. on 6 metres, 11/1/68, and during 1970 received the AX "Cook" Award and was presented with the Eastern Zone Activities Award for 1969-70, being the most active Amateur in the Gippsland area.

George eventually left the television industry, rejoining the Electricity Commission as an electrical control room operator in the Latrobe Valley power stations, thus working shift work which really suits Amateur Radio and DXing. George received his full call of VK3ASV in 1959. This has not greatly affected his v.h.f. and u.h.f. interests and hopes to build 1296 MHz. gear during 1971. He is currently testing his new 432 MHz. a.m. and 438 MHz. f.m. rigs with some success. He now has his Creed teleprinter operating, using AFSK on the 2 mx f.m. r.t.t.y. net to Melbourne and FSK on the h.f. bands. The h.f. bands are also used to find out the latest trends and overseas interests in v.h.f., and in his spare time studies the Japanese language!



George Francis, VK3ASV
How many microphones in the picture?

At the moment his shack consists of a FT200 and a FTV650 6 metre transverter. The FT200 has an added 6 KHz. wide K.V.G. crystal filter for a.m. reception. The 2 mx s.s.b. transverter is nearly completed. At the moment an FET converter and a home constructed 150w. high level a.m. transmitter is used with a single QB3/300 in the final, modulated by a pair of 6146s in Class AB1. The 70 cm. gear is still experimental. A Lafayette PF175 tuning 30-50 MHz. (and 150-175 MHz.) is used to monitor ground wave openings, and the MUF and "skip" approaching the 6 metre band, in conjunction with the t.v. DX receiver. A camera is partly constructed and a line/frame generator for a.t.v. For out-of-band reception, several general coverage communications receivers are used, Hallicrafters SX17A 530 KHz. to 65 MHz.; Marconi B28 l.f. 15 KHz. to 540 KHz., Lafayette Airmaster II, 108-137 MHz.; Lafayette Guardian 3000, 72-95 MHz.; u.h.f. t.v. converter, 400 to 950 MHz.

Outside the shack is an aerial farm of 30 aerials, including a 160 metre top-loaded vertical, 4 el. wide-spaced 6 mx horizontal yagi, 3 el. vertical 6 mx yagi, 6 mx ground planes for 53.032 a.m. and 52.525 f.m. net frequencies. For 2 mx a.m. a 16 el. horizontal phased array and for the 2 mx net transceivers, two 8 el. vertical phased arrays. A 16 el. phased array on 432 MHz.

Because of Channel 0 t.v.i. problems, George has good portable gear for 6 mx, consisting of a Lafayette HA750 solid state transceiver, crystal and tunable with 40w. linear, and 4 el. yagi. The rig can also be carried portable over the shoulder!

Thank you George for all that information. I don't know what time you have for sleeping? However, your call sign is certainly well known throughout the country and we wish you well in the future.

CONTEST CALENDAR

6th/7th March: 37th A.R.R.L. International DX Competition—Phone Section (2nd week-end).
13th/14th March: 34th B.E.R.U.
14th March: W.A.B. H.F Phone Contest.
20th/21st March. 37th A.R.R.L. International DX Competition—C.w. Section (2nd week-end).
27th/28th March "CQ" W.W. W.P.X. S.S.B. Contest.
28th March. W.A.B. H.F. C.W. Contest.
4th April: W.A.B. L.F. Phone Contest.
11th April. W.A.B. L.F. C.w. Contest.
16th/17th October: 11th W.A.D.M. Contest (c.w. only).

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WORKED ALL BRITAIN CONTESTS 1971

PRECIS OF RULES

Dates: 14th March, H.F Phone; 28th March, H.F. C.W.; 4th April, L.F. Phone; 11th April, L.F C.W.

Bands: For H.F Contest—14, 21 and 28 MHz. For L.F. Contests—1.8, 3.5 and 7 MHz.

Time: For all contests, 0900 to 2100 GMT.

Exchange: RS(T) number and QSO serial number commencing 001 plus book number if a W.A.B. book-holder.

Scoring: QSO points—5 points for each different station worked. The same station may be worked again on a different band for five points.

Multiplier—Total number of different W.A.B. areas worked in the contest, one multiplier for each area even if worked on three bands.

Total—QSO points multiplied by total multiplier.

Awards: Certificate of Merit to the leader in each country.

Log entry: To be received within 30 days of the contest by W.A.B. Contest Manager, 40 Baggrave St., Leicester, United Kingdom.

CANBERRA RADIO SOCIETY

EASTER CONVENTION—APRIL 9-12, 1971

This is our second notice regarding the forthcoming Easter Amateur Radio Convention and already the energetic committee working for you have taken the planning to an advanced stage. Firstly, may I tell you something about the programme arranged for you?

Friday: The reception centre will be open for most of the day at the Griffin Centre, Bunda St., Canberra Civic. Here you will be welcomed by club members, registered, supplied with a bag of goodies, and directed to your accommodation. Use 146 MHz. Channel B for all on-the-spot directions during the Convention. En route to the reception centre you may participate in an all-band scramble (open to mobileers only) in which you may work anyone, any mode on any band, but you submit **any one hour** of your log. Most of Friday is left free for sight-seeing and personal shack visits and some suggestions appear later in this programme. 3.5 and 7 MHz. will also be manned.

Saturday: A keen contest committee has organised a programme for those who are competition minded, starting at about 10 a.m. Some of the events listed here will be held on Sunday 40 metre cryptic c.w.; 2 mx fox hunt (a.m. and f.m.); 40 mx hidden tx hunt; 40 mx fox hunt; YL scramble; 2 mx hidden tx hunt (a.m. and f.m.); a mobile v.h.f. scramble with special rules; 2 and 40 mx receiving tests; and the usual ladies' tx throwing contest. Some excellent trophies have been donated and a special prize will be awarded to the highest aggregate points score.

The Convention Dinner will be held at the Hotel Canberra after a short cocktails session, commencing at 7 p.m.

Sunday: The contest committee will be active from 10 a.m. During the contests on Saturday and Sunday, there will be several conducted coach tours of the national capital for the YLs, the XYLs and the harmonics. At about noon we will commence the launch tours of Lake Burley Griffin and transport to Springbank Island in the lake where a barbecue luncheon is arranged. Here you will find gas operated barbecues, boys' and girls' toilet facilities, and large shady safe-playing areas for the children. If you have a trailable sail-boat, you should bring it. Private power craft are not allowed on the lake. Anglers bring your gear—see footnote.

In the evening there will be a get-together at the reception centre. Here we hope to keep you on your toes with a brief two-man debate on the pros and cons of various foreign transceivers. Also, we present the trophies, draw the raffle, and perhaps screen some movies. There will be a special trophy for the person who travels the greatest distance to the Convention, and some door prizes. There will be a White Elephant Sale, so bring all your unwanted gear. Label it with your name, call sign and, where applicable, the reserve price.

Monday: On Monday morning there will be organised mini-tours to tracking stations and to the Mt. Stromlo Observatory. Private shack visits will be arranged on Sunday night. There will be time to try the Tourist Bureau Golden Arrow Tour before you leave to journey home. This is a "drive-yourself" tour.

Footnote: The lake is stocked with carp, trout and some perch. No licence is required and there is no closed season. The club has a special prize for the son or daughter of any visiting Amateur who catches the longest fish on any day, 9th to 11th.

Other Attractions: Things to see include the Captain Cook Memorial Jet, the Australian War Memorial, the Carillon, Blundell's Farmhouse, Horse Era Museum, Parliament House, Tidbinbilla Fauna Reserve, nine Art Galleries, Royal Mint, etc., etc.

Reception Centre: At the reception centre there will be a continuous display of the latest Amateur Radio equipment, entries in the Best Home-Built Equipment (Open) and ditto (Youth Radio Scheme) will be shown and judged, and items for the White Elephant Sale may be put on the table at will. Cold drinks and tea will be available all day.

A comprehensive programme is to be published later. If you have any queries, please call the club station VK1ACA, on 3590 KHz. most nights at 9 p.m., or write to P.O. Box 1173, Canberra City, 2601.

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WGA 21 AWARD

The Radio Amateur Society of the Island of Gotland (GRK) in the southern part of the Baltic Sea has instituted the Worked Gotland Award 21 (WGA 21) which is available to every licensed Radio Amateur who complies with the following rules:

1. All contacts with SM1 (or SK1 or SL1) stations after 30th June, 1970, 2359 GMT, on all bands are valid for this very attractive award. The contacts shall be two-way (not cross-band) and in any mode which is legally allowed for the band used. WGA 21 cannot be awarded to Amateurs operating from Gotland itself.

2. Each QSO gives the following number of points (for non-Europeans) 80 mx 5, 40 mx 4, 20 mx 3, 15 mx 3, 10 mx 3, 2 mx 6, 0.7 or lower 10 points. The required number of points is 21.

3. Applications should be sent to the Awards Manager, Radio Amateur Society of Gotland (GRK), P.O. Box 461, S-621 04 VISBY 4, Sweden. Please enclose excerpt of your log, certified by two licensed Amateurs. To cover costs also enclose 10 IRC or 7.50 Swedish Kronor or U.S. $1.50. If you would like the award by registered post, please enclose 3 more IRCs or corresponding amount.

Note: On July 1-7 incl. each year most of the active Amateurs of Gotland are participating in a special activity week on all bands. There are almost 40 Amateurs on Gotland and half this number are active. Visitors to Gotland from other parts of Sweden use the epifix/1, as in SM0OY/1. Visitors from other countries with temporary licences in Sweden use the epix/SM1, as in OH0NI/SM1.

For WASM II. Gotland is laen 1, WAZ Zone 14, ITU Zone 18.

HAMADS

Minimum $1 for forty words.
Extra words, 3 cents each.

HAMADS WILL NOT BE PUBLISHED UNLESS ACCOMPANIED BY REMITTANCE.

Advertisements under this heading will be accepted only from Amateurs and S.w.l.s. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at P.O. 36, East Melbourne, Vic., 3002, by 5th of the month and remittance must accompany the advertisement.

EXCHANGE. Geloso G209R Receiver and Geloso G222TR Transmitter for Heathkit DX100B or DX100 with handbook. J. T. Edwards, P.O. Box 33, Moss Vale. N.S.W., 2577. Tel. M.V. 242.

FOR SALE. Crystal Calibrator No. 10, $5.00. Two brand new 6JS6B valves $3.00 pair. E. L. Blackmore, 30 Breen Ave., Kyabram, Vic., 3620.

FOR SALE. 2 Metre a.m. station including transmitter, receiver, mast, 16 element beam, balun, mike, in-built power supply, perfect order, $100. VK2BSG, Phone (Sydney) 57-8705. 8 Freeman Ave., Oatley, N.S.W., 2223.

RTTY FOR SALE. A number of each of the following units are available at very reasonable prices. Twin duplex converters, two-tone keyers, neon tuning indicators. I will send by road (pec. Made in U.S.A., some less tubes, all rack mounting. VK6GP, R. G. Price, 144 Robert St., Como, W.A.

SELL. Swan 500C, mint condition, fully updated, new a.g.c., a.l.c., plus Swan's new 16-pole filter. TH6DX Antenna. Two-section crank-up Tower, 42 ft. extended. A. R. Roy, Phone (Melb.) Business 67-4486. Private 20-5135.

WANTED: AR7 Coil Boxes. Prefer Band E or, even better, Amateur bandspread coils. Electrical condition secondary. Must be cheap. Also wanted, v.h.f. transceiver, cheap, a.c. supply preferred but not essential. D. R. Nagle, 2 Crudge Rd., Blacktown. N.S.W. Phone 622-1061.

WANTED: By W6SAI—Plug-in coils for restoration of old National SW3 and FB-7 Receivers. Contact VK3ATN, P.O. Box 80, Birchip, Vic., 3483.

WANTED: Coil Boxes A, B, C and E for R.A.A.F. Receiver Type AR7, and circuit diagram also. Contact David Mann, "Nunderoo," Tumbarumba, N.S.W., 2653.

WANTED. Command Receivers 3-6 and 6-9 MHz., preferably unmodified and in good order. Will pay good price for good units. Send particulars and price to B. J. Clarke, VK5VV/4, P.O. Box 193, Hughenden, Qld., 4821. All letters will be answered.

WANTED. Dynomotor for Collins ART-13 autotune transmitter. Must be operational. VK3TX, phone (Melbourne) 544-7779.

COOK BI-CENTENARY AWARD

The following additional stations have qualified for the Award:

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
973	DK3PO	1031	AX3KR	1090	ZM1PV
974	WB6IXC	1032	K4RHQ	1091	W5ZWX
975	AX3BDT	1033	KH6EOQ	1092	KX6HW
976	AX5UC	1034	AX9AC	1093	AX9GN
977	AX3UT	1035	ZM2VH	1094	AX2QL
978	JA1VJR	1036	W1KXM	1095	AX7ZD
979	DK1UJ	1037	AX2DI	1096	AX2AZY
980	HK3AVN	1038	G3LGS	1097	AX2UJ
981	VE1AM	1039	W4QAW	1098	VU2IAZ
982	KZ5HA	1040	9V1QH	1099	AX2BGG
983	LA9CE	1041	AX3AQY	1100	G3TRV
984	W3PVZ	1042	VP9GE	1101	JA3TCH
985	GW4NZ	1043	W2ANX	1102	AX2ATT
986	K6PHT	1044	GM3VEY	1103	AX3JF
987	ZM2RP	1045	ZM1PN	1104	F9MS
988	AX8JS	1046	WA6ZSJ	1105	WA6EEF
989	VO1FB	1047	W4RM	1106	KA2AI
990	AX6FT	1048	JA6CRA	1107	9J2WR
991	JA1KXN	1049	W1FJJ	1108	ZM1AMM
992	VO1BD	1050	JH1MTR	1109	AX3AFH
993	WA6TAX	1051	VE3BME	1110	W5RBO
994	SM6BBC	1052	ZL1AAP	1111	ZL1BGC
995	SM6CKS	1053	VE3AYM	1112	CR7GJ
996	K6UNT/	1054	W8ILH/	1113	VP7NO
	KL7		VE6	1114	AX3BAX
997	W9WNB	1055	AX4FD	1115	W7UOI
998	W8OPZ	1056	AX5BX	1116	AX4FK
999	W6RUB	1057	AX3BCL	1117	AX3VX
1000	AX5GM	1058	W9AIZ	1118	AX3GC
1001	AX2AGI	1059	AX5GD	1119	G3SRH
1002	ZS6QK	1060	AX4CP	1120	AX4PV
1003	AX9NI	1061	AX4LB	1121	AX3BBY
1004	W0VPR	1062	ZL1BBM	1122	ZM1AVS
1005	W0NAZ	1063	VE3BNC	1123	WB4FOD
1006	ZM2SX	1064	HB9AHA	1124	I1BCB
1007	I1LPR	1065	I1SSU	1125	ZS6GF
1008	W6JXH	1066	AX9KS	1126	WA6YJJ
1009	AX2HM	1067	XE1DP	1127	9M2AV
1010	K7YWZ	1068	KH6BWT	1128	DL6NP
1011	K4BZF	1069	AX3AGF	1129	AX6VB
1012	YV1KZ	1070	W1OKG	1130	9M2LN
1013	W2PGU	1071	YB0AAE	1131	DL1MD
1014	AX3AJR	1072	UA1IG	1132	AX8CW
1015	AX7JF	1073	UA0MI	1133	W6PXZ
1016	AX2NM	1074	UA3FF	1134	DL3OH
1017	KC6WS	1075	UA9PG	1135	ZM1AZX
1018	HK4TA	1076	UW0IW	1136	W9ICF
1019	KC4USL	1077	UW0IQ	1137	W3PVO
1020	ZM1ABW	1078	UA0DG	1138	AX8UK
1021	K8LIK	1079	UL7JG	1139	AX3AEF
1022	VE8SH	1080	UK5WAZ	1140	JA1SGX
1023	VU2BEZ	1081	UK5UAL	1141	G3CDK
1024	DJ7MI	1082	AX2RX	1142	AX3BAS
1025	YB0AAN	1083	VE1TG	1143	W0BK
1026	AX2WD	1084	ZM2AVY	1144	AX2AWS
1027	AX6PG	1085	W2SUA	1145	YB0AAO
1028	W2HO	1086	EA2HX	1146	JA3REK
1029	JA3TRO	1087	ZL2BDK	1147	WA4WTG
1030	ZS1LJ	1088	ZL2AUP	1148	G3LCS
		1089	VE6ARD		

V.H.F./U.H.F. SECTION

The following additional stations have qualified for the Award:

Cert. No.	Call	Cert. No.	Call	Cert. No.	Call
7	AX3ZYT	11	AX5ZLZ	16	AX5ZNJ
8	AX3ZOP	12	AX2ZTM	17	AX4ZRG
9	AX3IO	13	AX5ZRS	18	AX3PC
10	AX4ZJB	14	AX2ZTQ	19	AX4ZGA
		15	AX2ZWL		

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W.I.A. V.H.F.C.C.

Amendment:

Cert. No.	Call	Confirmations 52 MHz.	144 MHz.
46	VK3ZNJ	250	—
47	VK3ZNJ	—	265

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W.I.A. 52 MHz. W.A.S. AWARD

New Members:

Cert. No.	Call	Additional Countries
90	VK4ZJB	2
91	VK3AUN	1

AMATEUR FREQUENCIES:

ONLY THE STRONG GO ON—SO SHOULD A LOT MORE AMATEURS!